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Notes on Old Methods of Lighting.

[By "A LONDONER."]

The lectures delivered on the occasion of the Centenary celebration of the introduction of gas as an illuminant, which celebration was held in Philadelphia a few months ago, served to remind us how comparatively recent is artificial illumination as we now understand it. The introduction of gas met with a surprising amount of opposition. In 1833 a petition signed by several hundred people addressed to "The Honorable, the selected and Common Councils of the city of Philadelphia," protested against its use in forcible terms; and the newspapers in Germany at the beginning of the century had also objections to urge. The introduction of gas, it was said, would prove distracting to traffic, would induce people to linger in the streets when they ought to be in bed, thus producing much wickedness; moreover, to turn night into day was clearly an unnatural and impious proceeding.

In the same way, in Great Britain, people found it impossible to understand how gas could be passed along pipes. At a Royal Commission on the subject it was asked whether gas could be turned on and off "like beer from a barrel," and whether it gave off sparks while burning; also, whether it burnt inside the pipe all the way along.

Looking backward it seems not so very unnatural that an illuminant which could be transmitted a distance should have seemed so strange. In the Eighteenth Century oil lamps were exclusively used. A quotation from an old book, by Professor Beckmann, of Gottingen University, reads as follows:

"At present (1786) the lamps of London are all of crystal glass; each is furnished with 3 wicks; and they are affixed to posts; they are lighted every day in the year at sunset. Oxford street alone is said to contain more lamps than all Paris. * * * The roads even 7 or 8 miles round London are lighted by such lamps, and as these roads are very numerous the lamps seen from a little distance have a most beautiful and noble effect." In the house, too, petroleum lamps were used by the richer class, or chandeliers of wax candles, while the poor man had to be content with the tallow dip.

Looking back still further, to the age before the introduction of petroleum, we find the methods of lighting available very primitive indeed. Some interesting examples of these old lamps were recently given in an article in "The Illuminating Engineer" (London, England[1]), which describes the collection of Mr. Johnston, of Hendon. Fig. 1 shows a series of lamps from Egypt and Nigeria. These are

Fig. 1.—Old Forms of Egyptian and Bronze Lamps.

only small clay vessels, which were filled with crude oil, and had one or more holes for the wick. Some of them dated back a few hundred years B. C., but it is said that there is one lamp which is actually more than 4,000 years B. C.—about the date of the first king of Egypt.

Simultaneously with the use of very primitive lamps, containing animal or vegetable oils, we may note the use of pine splinters which were gripped in suitable wooden clips and formed the sole illuminant of the poorer class. In some cases pine wood was used and in Scot-

1. August and September, 1912.

land these were called "Peermen" or "Puirmen." The origin of the name arose from the fact that such splinters were commonly cut and sold in bundles by poor men, tramps, etc. Sometimes instead of resinous wood rushes were used, which were prepared in a special way, the rushes being first dried and stripped, then soaked by the careful housewife in coarse fat or grease. Sometimes this rush was mounted in a clip, while in other cases it was merely allowed to rest on top of a piece of furniture, becoming extinguished when the projecting burners burned away. It it said that the edges of old furniture are often found burnt into shallow grooves through this practice. The rush light was really the primitive candle, and was used by the poor man long after the use of wax candles had become the usual means of illumination for the rich.

Fig. 2 shows a series of clips of this kind; and Fig. 3 shows some ingenious forms of Chinese oil lamps constructed from bamboo.

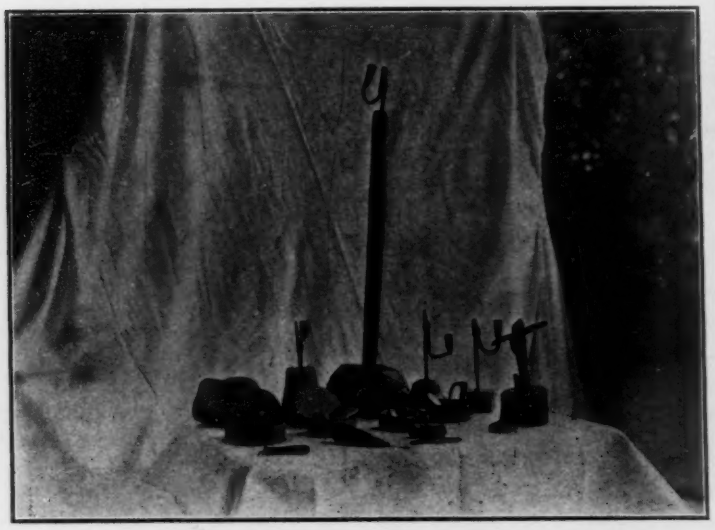

Fig. 2.—Rushlights; Peermen Tinder Boxes, etc.

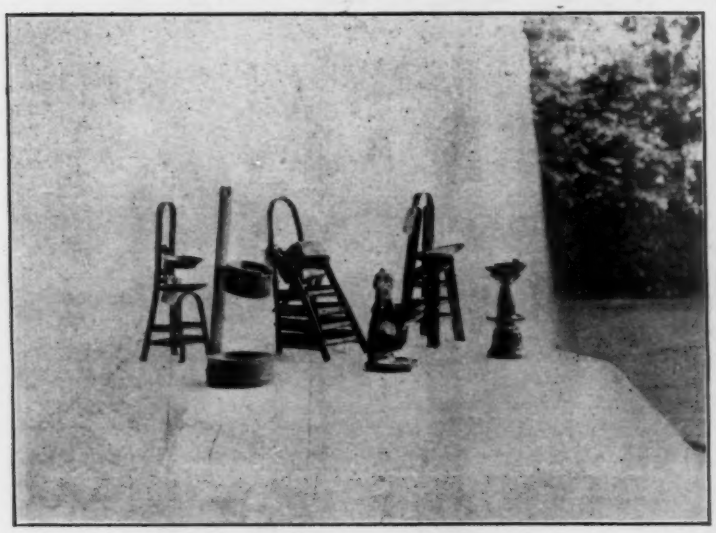

Fig. 3.—Chinese Lamp, Made of Bamboo.

Another type of lamp which is interesting is the "Crusie," shown in Fig. 4. These lamps were shallow vessels, containing several recesses from which wicks could emerge. In Scotland they were often beaten out of iron by local blacksmiths, and would sometimes last in the same family for 100 years. It is most curious to see how this form of lamp assumed substantially the same form in countries so distant as Scetland, Norway and North Borneo. However, the shape given it was frequently affected by the traditions of the country. For example, in Norway lamps were not infrequently made in the form of a boat. There are in existence some very ornamental and graceful forms of Crusies. But the illumination produced must have been very feeble, in that the lamps burned coarse oil, which gave rise to acrid fumes. They also flickered and required constant attention.

Commenting on these old lamps, "The Illuminating Engineer" points out that, in spite of their feebleness as illuminants, it would often be possible for the fixture designer of the present day to imitate their design with advantage. Many of the lamps used for religious

Fig. 4.—Collection of Crusie Lamps, Various Countries.

Fig. 5.—Mosque Church Lamps.

purposes in mosques and temples and in Venice were of exquisite design. Sometimes they were arranged to illustrate some legendary instance, or were provided with some design to symbolize the use to which they were going to be put. At the present day, when we turn out our lamps by the thousand in a uniform pattern, we are somewhat apt to lay stress on high efficiency and not to pay sufficient attention to the artistic possibilities of illumination.

MR. ALBERT RAEISH, for many years in charge of the electrical division of the properties of the St. Croix (Me.) Gas and Electric Light Company, has resigned from that service, to accept a responsible position with an electrical supply firm in Portland, Ore.

Symposium on High Pressure Gas Lighting, in Three Parts.

PART I.—High Pressure Gas Lighting in Great Britain.

[Communicated by Mr. F. W. Goodenough, Sixth Convention, Illluminating Engineering Society.]

I am honored by a request to write a communication descriptive of the progress made with lighting by gas under increased pressure in Great Britain, more particularly in the City and County of London, with which situation I am best acquainted. I will, therefore, endeavor to give a brief account of the development and present position of high pressure gas lighting in this country. Before doing so, I might perhaps with advantage explain, in as non-technical language as possible, the main objects in view in working with gas at a higher pressure than is normally supplied in the mains.

With the ordinary pressure available, say 2 to 4 inches (5.08 to 10.16 cm.) water gauge, it has not so far proved practicable, in an incandescent burner, to obtain the aeration of the mixture necessary to give the maximum flame temperature; or to impart sufficient energy to the mixture to overcome the resistance of the burner and mantle at an adequate velocity. The latter is not only necessary to get the maximum incandescence to the mantle, but also to prevent the lighting back of the mixture.

The importance of obtaining the highest flame temperature will be appreciated when it is realized that, according to the best authorities, the light emitted by a mantle increases as the twelfth power of the absolute temperature. It has been stated to be as high as the fourteenth power; but, even if the rate of increase was considerably less than the lower of these two estimates, it will be seen that every degree of temperature that can, by any reasonable and economical means be added to the flame, will pay handsomely.

So far as I can discover, the earliest form of high pressure burner and apparatus was devised by a Belgian gas engineer (Mr. Greyson de Schott, of Namur), about the year 1896. This found its way into England in the following year. The device consisted of an upright burner giving about 300-candle power, and the compressor was a somewhat crude apparatus, driven by water pressure, with a large gas bag on the inlet and outlet of the pump. The apparatus was not automatic in its action, but had to be regulated by hand, the outlet pressure being kept steady at 8 inches (20.32 cm.) water gauge by a governor on the outlet of the high pressure gas bag, which latter was inclosed in a net. While the burner and apparatus were very crude, they showed the possibilities of increased pressure, as not only was the efficiency of the ordinary burner about doubled, but the possibility of larger units of light than had hitherto been available was demonstrated. In the following year a considerable improvement was effected in the compressing apparatus, with the introduction by the James Keith & Blackman Company, of London, of an improved form of water compressor from which most of the objectionable features of Greyson's apparatus were removed. In this apparatus the pressure, which was still 8 inches (20.32 cm.) water gauge, was obtained by substituting for the solid piston a double-acting, water-sealed bell, actuated directly by a water motor, the delivery from the pump being passed into a small holder weighted to the desired pressure. The holder was arranged to control the water supply to the motor so that the latter was quite automatic in its operation, starting and stopping with the turning on or off of the gas at the burner.

For several years this and similar types of apparatus were chiefly used, although certain other, more or less successful, attempts were made to produce pressure by other means, such as by water injectors, pumps driven by hot air motors, by electric motors, etc.

Mention must especially be made of the work in this direction of the late Mr. William Sugg and his firm, by whom were carried out successfully a number of important installations, including one at the Marylebone Station of the Great Central Railway, and a particularly striking one on the outer railings of Buckingham Palace.

Among other experiments in the field of increased pressure gas lighting, an interesting and ingenious arrangement may be mentioned—viz., the Scott-Snell, self-intensifying lamp, in which the waste heat from the burner was employed to operate a form of hot air motor, which in turn raised the pressure of the gas used in the burner by means of a pump. Later on it was found more satisfactory to pump air instead of gas and inject this into the burner in order to give the necessary aeration and velocity to the mixture. Unfortunately, however, the delicacy of the apparatus necessitated too much attention for practical working.

In the meantime, various other attempts were made to increase the aeration of the mixture, by other means than by increasing the gas pressure, the chief of these being known as the "Lucas," self-intensifying lamp, in which a long chimney is utilized to assist the injector by drawing an increased quantity of air through the Bunsen tube. Many variations have been made on this principle; but the limitations, due to the great length of chimney, and to other difficulties which need not be entered into here, have prevented a general adoption; and, while the results were an advance on those obtained from ordinary burners, they could not be compared with those eventually obtained by the high pressure system.

In the meantime considerable improvements in the latter system were made in regard to the details of burners and lanterns, fittings, etc.; but, as in all these systems, the vertical burner was used; and, while the practical working was much improved, very little advance in efficiency was made on the results achieved by the original Greyson burner. In some cases higher pressures were used, but the benefit of such higher pressure was doubtful, being indeed to a large extent necessitated by the crudeness of some of the burners employed.

The introduction of the inverted burner for low pressure did not at first appear to give any scope for the use of high pressure, as the principle upon which the ordinary low pressure, inverted burner works did not necessitate such a highly aerated mixture (in fact, the burner would not work with it) as was used with the upright, high pressure burner; but, after some little time, it was found that if, instead of causing the flame merely to lick the inside of the mantle, while allowing the products of combustion to pass out between the ring and the burner tube, the flame was forced through the meshes of the mantle by means of high pressure, and the products of combustion were made to pass away from the outside of the mantle, a considerable improvement was effected over the results obtained at low pressure. To do this it was, of course, necessary to close the space between the ring and the burner nozzle.

In the year 1907 a great impetus was given to high pressure gas lighting by the introduction of a new type of inverted burner, by the Keith & Blackman Company, in which a large proportion of the waste heat from the burner was utilized to preheat to a considerable extent the mixture of gas and air before the point of ignition. Owing to the greatly increased resistance caused by this burner, due to several reasons, into which I need not enter here, it was found necessary to raise the pressure used very considerably; namely, to about 54 inches (1.371 m.) water gauge, or say 2 pounds per square inch. Under certain circumstances, it was found that even higher pressures are necessary. In fact, the whole tendency seems to be to increase the pressure, and, as far as can be at present foreseen, any further advance in efficiency must be accompanied by additional increase of pressure.

The immediate result of this new system was to double the efficiency of the light; and, with a gas of average quality, an illuminating value of about 60 candles per cubic foot was obtained. Not only was the efficiency raised to this extent, but the size of the mantle required for a given unit of light was very much reduced. This reduction in the size of mantle, in relation to the candle power evolved, made it possible to obtain practically very much larger units of light than had hitherto been possible; and as its advent was practically coincident with the widespread adoption of the flame arc lamp, a general tendency towards the use of very large units of light was to be observed as a consequence—one of doubtful value from the illuminating engineer's point of view.

So far as I can gather, the average quality of gas in the United States is considerably higher in candle power and heating value than in Great Britain; so that there should be no difficulty with such gas in obtaining considerably higher results than 60-candle power per cubic foot. Mr. C. A. Luther, of the Peoples Gas Light and Coke Company, Chicago, Ills., has, in fact, recorded as high an illuminating value as 80 candles per cubic foot with one of the Keith lamps. The possibilities of this system were demonstrated, for the first time to the public, in a very striking manner by the lighting with Keith lamps of a large portion of the grounds of the Franco-British Exhibition, and of the grounds of the Scottish National Exhibition, held in Edinburgh, both in the summer of 1908.

The necessity for a higher pressure for such types of burners made it compulsory to depart from the automatic, water driven type of compressor, and its contemporaries, and to adopt a more positive type of compressor driven by power. The most usual form is of the rotary blower type, somewhat on the principle of a gas exhauster; but, fitted with suitable arrangements for regulating the pressure, so as to keep

it constant independently of the number of burners which are in use, or any variations in the speed of the driving power.

The introduction of the inverted, high pressure burner has also revolutionized the type of lantern used, more especially for outdoor purposes, and has led to the universal adoption of the so-called "arc" type of lamp with suspended globe. Even in the days of the lower-powered, high pressure, upright burner, it was found that the square or hexagonal lantern, generally fitted with flat panes of glass, was not the most suitable type, since great trouble was experienced with the breakage of glass due to the considerable volume of radiant heat. It was also found that, while formerly it had been the best practice to construct the tops and chimneys of outdoor lanterns of copper, this material very rapidly oxidized and flaked away in high pressure lamps owing to the high temperature of the products of combustion. For outdoor high pressure lamps it was found that a lamp casing and chimney made of enamelled steel, when properly designed, had a much longer life than the copper lantern; and, with the introduction of the inverted burner with still higher pressures and much higher lighting units, the difference was even more marked, with the consequence that in the present day the use of copper lanterns has almost entirely given way to enamelled steel casings for high pressure outdoor lighting.

With the new or "arc" type of lantern, globes made of ordinary glass were at first used, and gave good service as compared with the flat-pane type; but, on the introduction of the larger units of lighting, and the demand for lamps of smaller dimensions, it became necessary to substitute globes made of the best fireproof glass.

Public Lighting.—On the first introduction of the high pressure system, most of the installations carried out were for private consumers, generally for the lighting of factories, and a very great number of plants had been installed for this purpose; but its great value as an illuminant for street lighting purposes soon became apparent, so considerable use has been made of it for public lighting both in London and in the provinces.

The beginnings in this direction were somewhat modest, and mainly consisted of isolated units on island street "refuges," generally over public conveniences—mainly for the reason that a position had to be found for the use of the water-driven compressor usually employed. This gradually extended to the lighting of important junctions of streets, such as at Ludgate Circus, outside the Mansion House, in front of the Royal Exchange, etc., and to Blackfriars, London, and Vauxhall bridges across the Thames.

These demonstrations so conclusively proved the value of the high pressure system for street lighting, that, in the City of London proper, a considerable extension was made in the laying down of mains which were fed from a central point where the compressor could be fixed. One of the most important of these was in the neighborhood of Billingsgate Fish Market, and the streets around the Monument on the city side of London Bridge. About the same time a very important installation was completed in Queen Victoria street, from the Bank to Blackfriars. In this particular installation advantage was taken of the fact that a subway runs the entire length of this street, and that a high pressure main for feeding district holders in London from the gas works at Beckton already existed in this subway. As, however, the pressure in this main fluctuated, it was necessary to control each lamp service by means of special governors, reducing the pressure to a constant 8-inch (20.32 cm.) water gauge, the governors being fixed in the base of the lamp columns.

Shortly after this, the opening of the new thoroughfares of Kingsway and Aldwych gave an opportunity for the introduction of high pressure gas lighting, advantage being taken of the subway which was constructed to lay special high pressure mains. Lanterns, fitted with clusters of 2 and 3-light, upright burners were fixed on tall steel columns, and a pressure of about 40 inches (1.016 m.) was used on the millenium principle, which had been largely adopted in Birmingham. The compressors and engines were fixed in an adjacent vault.

Another important installation of lamps, with upright burners at 16 inches (0.406 m.) pressure, was supplied by Messrs. William Sugg & Co., for the lighting of Whitehall and Parliament streets, in 1905.

At the end of the year 1908, owing to the impetus given by the successful lighting of the Franco-British Exhibition, the city authorities decided to light Fleet street by means of the newer system of high pressure inverted burners, and these were duly installed and lighted on Christmas Eve. In order to reduce the obstruction previously caused by lamp-posts the lanterns were suspended from large brackets fixed on buildings. A large compressing plant was put down in an adjacent street, with a view to extensions of street lighting, and also with a view to supplying private consumers with high pressure gas for the lighting of factories, printing houses, etc., on the line of route. The installation was shortly afterwards extended for the lighting of Ludgate Circus, New Bridge street and the approaches of Blackfriars' Bridge. Subsequently a large number of important printing houses taking advantage of this main installed the high pressure system both for lighting and for furnace heating. Among others may be mentioned the premises of Messrs. Cassell & Co., Ltd., and of Messrs. Bradbury, Agnew & Co., the well-known printers of the world-renowned *Punch*.

The success of these installations (particularly that in Fleet street) encouraged other local authorities to investigate the claims of high pressure gas, and, in 1910, tenders were invited by the Corporation of the city of Westminster for the relighting of some of the most important streets in their area, comprising: Regents', Pall Mall, St. James, Whitehall, Victoria, Westminster, Piccadilly, Shaftesbury avenue and Charing Cross road.

The terms of this contract (based upon the contracts for the lighting of Kingsway, Aldwych and Whitehall) were somewhat novel, as a minimum candle power had to be guaranteed by the successful tenderers against a penalty. This form of contract is now known as the "Westminster specification," for which Mr. J. W. Bradley, the City Engineer, was primarily responsible. The Gas Light and Coke Company was successful in securing the contract for this work for a period of 5 years.

The result has fully justified the action of the Westminster City Council, and their engineer, as the streets above mentioned now comprise, without question, the finest lighted areas to be found anywhere. Reports are published from time-to-time giving the results of the regular testing of these lights by the Council, from which it is seen that the average result obtained is well above the guaranteed minimum in all cases.

Other important installations have been put down in Birmingham, Glasgow, Cardiff, Manchester, Newcastle and other leading provincial cities. Recently a portion of New Oxford street and High Holborn has been lighted by high pressure gas, and it has also been decided to relight some of the principal thoroughfares in the City of London proper by this means.

In the latter scheme all the thoroughfares originally lighted by high pressure gas on the earlier systems, with some additions, will be converted to the newer system of inverted burners, but with very much higher lighting units. In many cases, instead of the lamps being fitted to columns or brackets, they will be suspended from the middle of the street by means of wire ropes, and arranged in such a way that they can be drawn to the side of the street and lowered within the pavement line for maintenance, the lighting and extinguishing being controlled from boxes on the wall.

In the meantime, other countries on the Continent of Europe have not been slow to recognize high pressure gas lighting as an efficient illuminant for street lighting where large units of light are desired. The most notable instance is that of the City of Berlin, in which many miles of the principal streets are now lighted by means of high pressure gas. Moreover, it has recently been decided to relight the main streets of the City of Paris by high pressure gas.

For all this I consider it necessary to say that, while fully recognizing the value of high pressure systems for securing maximum efficiency, where large units of light are specially desired, I think the craze for such large units has been carried too far; and to point out that recent advances in the efficiency of low—*i. e.*, ordinary—pressure inverted burner lamps have made it necessary always to draw up a careful balance sheet of the total cost per candle power required, taking all factors of initial and running costs into account, before deciding whether to adopt high or low pressure systems of lighting. The higher the price of gas the stronger the case for high pressure, which economizes in gas consumption, while being more expensive in first cost and maintenance. Obviously, no one would choose a high pressure in preference to an ordinary pressure system unless the former showed a substantial saving per candle power developed.

Parade and Scale Lighting Systems.—Under this heading I propose to give a few facts about a system of high pressure gas distribution which has made great strides within the past few years. This is known as a "scale," or inclusive charge, system, under which the consumer pays an inclusive price per lamp per annum according to "scale," the price varying with the desired hours of lighting. It was originated by some of the gas companies in London making arrangements with a limited number of shopkeepers in a block of

buildings, sometimes known as a parade (hence the name) to put down a small compressing plant in an adjacent basement, and run a supply along the building fronts to feed high pressure lamps outside the shop windows.

Owing to the fact that a constant pressure can be relied upon, the consumption of such lamps per hour is a known quantity; and as the control of each of these plants, and the lighting and extinguishing of the lamps, are in the hands of the gas company, it was a simple matter to arrange a fixed price per annum to cover the cost of working, the hire of lamps, maintenance, gas supplied, etc.

In order to meet the varying requirements of different tradesmen, a schedule of rates is arranged according to the hours of light required. While they are all lighted automatically by the starting of the compressor at the same hour, they are extinguised by the companies' men at different times, according to requirements. In this system there is no necessity to meter the gas and it does not enter the consumers' premises. The immediate success of these small installations led to their being rapidly multiplied, so that in certain instances it was found more economical to couple them up by means of a main worked from some central point, thus doing away with the smaller compressing units. Owing to the popularity of this arrangement, many of the gas companies in London have now put down long runs of high pressure mains for supplying lamps on this system. The mains are generally run under the pavement on each side of the street, so that the roadway has not to be disturbed to make a connection.

The Tottenham and Edmonton Gas Company, which was one of the first companies to go in for this system on an extensive scale, has now some 12 miles of mains entirely devoted to this purpose, and the South Metropolitan Gas Company has recently extended its system to 14 miles.

At the present moment, in London and vicinity, it is calculated that there are over 12,000 lamps, of an average candle power of 1,000, now in use supplied by 6 gas companies, and these are being constantly added to. The majority of these have been fitted up within the past 2 years. In the Gas Light & Coke Company's area there are over 3,500 of these lamps supplied on this system.

In the case of the main by which they supply the cities of Westminster and London, a constant pressure is kept up and a supply is available, not only for scale lighting, but also for various factory and industrial purposes through the daytime. A very large installation on this main is Victoria Station of the London, Brighton and South Coast Railway, which is lighted throughout by high pressure gas.

Factory Lighting.—It is only within the past 2 or 3 years that much progress has been made in public street lighting and the "scale" lighting before referred to, but high pressure gas lighting secured a firm footing in factories and workshops almost from its first introduction, and it is chiefly in this field that the system has been developed in the past.

The existence of power on the spot, or the presence of workmen who can look after the running of a plant, are factors in favor of adopting the system in the case of such premises. The flexibility of the size of units is also an advantage, as it is possible to use efficiently from 1 cubic foot per unit up to say 75 feet and more from the same supply; while in many cases the high pressure gas can, at the same time, be advantageously used for industrial heating purposes. A notable instance of this dual purpose is seen in the case of laundries where the high pressure gas is used for heating the gas irons and rollers of machines in place of the old air-blast system, with a considerable economy (amounting in some extreme cases to as much as 50 per cent.) chiefly owing to the better control and regulation of the mixture.

Within the past few years there has been in Great Britain a marked advance in the use of town gas for all sorts of industrial heating and melting purposes, and this advance has been largely brought about by the convenience and efficiency of high pressure gas for such purpose. In the city of Birmingham a large high pressure main has been put down, distributing over a large area gas at 15 pounds per square inch, chiefly for such purposes, its use for street lighting being merely a secondary consideration.

The laying down of such mains will have a marked influence on the progress of the use of high pressure gas for all purposes, as they do away with the inconvenience of individual compressors. There are still a few problems to be solved in the successful metering of such supplies, and, while meters are manufactured for this purpose, hey have not yet come into general use. The difficulty lies in the fact that under varying pressures the gas has a varying volume, and this has to be compensated for. I have little doubt that in a very short time this problem will be satisfactorily solved, as other difficulties have been overcome in the past.

I will conclude these very inadequate notes by repeating that, while illuminating engineers, as well as the gas industry, have much, and may in future have still more, for which to thank those who have devoted much time, money and ingenuity to the development of high pressure gas lighting, and while it may be true that the future of gas lighting for trade purposes may lie in that direction, the battle is still in progress between special or high and normal or low pressure systems, and every case must be considered on its merits. The latest advances have been in favor of the normal pressure; but, where a large number of very large units of light are required, the high pressure system is easily first.

PART II.—High Pressure Gas Lighting in Germany.

[Communicated by Mr. Oscar Klatte.]

Remarkable development in high candle power gas lighting, both by means of gas under high pressure (about 2 pounds) and by the use of gas at ordinary distribution pressures and air under high pressure (about ½ pound), has taken place in Germany during the past 10 years, so that in nearly all of the leading cities one or the other of these systems is in vogue. These systems are used for lighting the principal thoroughfares, and squares or parks, and many ingenious methods for lowering the lamps for trimming have been devised.

Many of the streets are lined with trees, so that, to obtain the best illumination results, it has been necessary to hang the lamps over the center of the street. This has been accomplished both by the use of a pole with long projecting arm and by a wire suspension device, the wire being attached to the poles on opposite sides of the street.

Where the pole with the arm has been used, the latter is made with a double-swing joint, so the lamp may be lowered to a convenient point for trimming. Where wire suspension is used, a travelling block is installed, so that the suspension-hook may be hauled to the side of the street and the lamp lowered so as not to interfere with traffic. Where this method of suspension is employed the gas or air connection is made through a flexible tube. The lamps used have 1, 3, 4 or 5 mantles, and vary in candle power from 500 to 4,000.

An indication of the growth of this form of lighting is found in the city of Berlin. Up to 1905, about 15 miles of street were lighted with electric arc lamps, and from 1905 to 1911 one mile of electric lighting was added. In 1905, about 4 miles were lighted with high pressure gas, but during the period from 1905 to 1911, 32 miles of high pressure gas lighting were added; and a further extension of 42 miles is contemplated.

While the use of pressure gas lighting is more or less commonly seen in various parts of the world for street lighting, in Germany it is used, not only for lighting streets, but also for lighting freight stations, amusement parks and similarly inclosed or semi-inclosed spaces where high candle power units are suitable; and the use of this method of lighting with single mantle units and indirect fixtures is being developed for the illumination of drafting-rooms and schools. Indications point to a greatly increased development of this method of lighting for all purposes.

PART III.—High Pressure Gas Lighting in America.

[Communicated by Mr. R. N. Zeek.]

High pressure gas lighting in America has not reached the same state of development that it has in either England or Germany. This undoubtedly has been due to the fact that pressure gas lighting has never been pushed in this country as a commercial possibility; however, with the number of installations now being operated successfully, there is every reason to suppose that this form of lighting will take its place among the more common ones. I shall attempt to confine this paper only to a description of each of the 6 installations at my command; but a few words, giving the reason for the advent and also the development of pressure gas lighting, will not be amiss at this point.

It is a well-known fact that increasing the pressure of the air or gas delivered to a lamp increases the efficiency at least 40 per cent. That is to say, if the candles per cubic foot of gas consumed for a low pressure lamp are 15, then the candles per cubic foot of gas consumed for this same lamp, if supplied with pressure gas, would amount to 21. It does not follow, however, that low pressure lamps can be installed on a high pressure system with satisfactory results. The products of combustion from such an installation would be entirely too

hot and abundant to insure the positive operation of the appliance. Then, again, the air ports of a low pressure lamp are altogether too small to supply the requisite amount of air for higher consumptions. The above increase in efficiency is due to the fact that the mantles can be made much longer, thereby exposing a greater surface to the Bunsen flame, and requiring only a slight increase in consumption to obtain this long flame as well as the attaining of a higher temperature. This fact, together with the increasing popularity of high pressure gas distribution, indicates that it is only a question of time when lamps can be installed in any locality and connected to the high pressure mains through individual governors.

The installations which I propose to describe are in Philadelphia, Pa.; Waterbury, Conn.; Wilmington, Del.; Washington, D. C.; Des Moines, Ia., and Chicago, Ills. The installation in Philadelphia consists of 7 2-arm, ornamental posts, equipped with 14 2-mantle lamps, located on Broad and on Arch streets, around the United Gas Improvement Company's building.

The ordinary pressure in a gas mantle fed from the mains is about 1.5 ounces, but in the system under consideration this pressure is increased by a blower to 2 pounds. The gas comes from a street main through a special service, passes through the meter, then through an anti-fluctuator, placed in the line to prevent any possible fluctuations from the compressor being noticed in the service. From the blower the gas goes to a storage tank, through a relief valve so adjusted that, when the pressure is in excess of 5 pounds, the gas is by-passed through the relief valve and through the inlet to the governor. The storage tank in this case is a 100-gallon, hot water boiler, and its great capacity prevents any fluctuation being communicated to the governor. From the storage tank the gas is conducted through a governor weighted to throw an outlet pressure of 2½ pounds, thereby insuring 2 pounds at the lamp.

The blower or compressor is, in this case, directly connected to a specially wound motor; but there is no reason why the compressor could not be run by a belt to either an electric or water motor, or a gas engine. In some of the installations gas engines are used to drive the compressor, and are so located that they can be used for demonstration purposes.

A separate line of piping was run to supply the pilot lights of the lamps. This pilot is controlled from a point in the basement, and the compressing plant has a valve, arranged with a lever, which may be set in 3 positions; one entirely off, which is the position of the cock when the lamps are burning and the pilot gas is entirely off. The second position is with the valve about half-way open, which is the position during the day or when the lamps are extinguished. The third is when the valve is entirely open, giving a long jet, or practically a flash-pilot, which is used only for a short time when the lamps are being lighted from the pilot, or when the pilot in turn is being lighted from the lamps. The entire compressing plant is installed in duplicate as an emergency precaution.

A few figures on the illumination obtained from these lamps will be of interest here. The 2 lamps on each post are hung 16 feet 6 inches (4.03 m.) above the pavement, while the posts are spaced 35 feet 6 inches (10.82 m.) from center-to-center. Considering the plane of illumination 3 feet (0.609 m.) above the pavement, the average illumination was 3 foot candles. These readings were taken within a radius of 15 feet (4.57 m.) from the base of the post, and, strange-to-say, all of the readings were very uniform. This was undoubtedly due to the fact that, directly below the mantle where the distance was the least, the smallest possible incandescent surface was exposed to the disk of the illuminometer.

The shape of the light distribution curve from the lamp bears out this argument. The shape of this curve indicated that the lamps were peculiarly well adapted to street lighting, since directly below the lamps the candle power is 480, and at 65° the candle power is 920.

In Waterbury, Conn., the case is an entirely different one. Seven single-mantle lamps are installed on as many posts at the approach to the railroad station. A high pressure main supplying an outlying district passes through this locality which fact made the installation of high pressure lamps a very economical and easy one. The pressure on the main line supplying these posts varies from 10 to 20 pounds per square inch (6.45 sq. cm.) during a 24 hour day. This pressure is reduced by means of a small governor, 3.5 inches (8.89 cm.) in diameter, located on the line in the base of each post, to 2 pounds which is the pressure best adapted to this particular lamp. The lamp is operated by means of a pilot light supplied through the main cock at the lamp, which cuts off the pilot during the lighting hours. The lamp cocks are operated by a lever with a light rod attached, extending down the post to within 8 or 10 feet of the ground, for convenience in lighting and extinguishing. The installation at Wilmington, Del., is similar to the one above described in operation in Philadelphia. There are 4 single-mantle lamps installed on posts on the Market street front of the Gas Company's building. The pressure is obtained by means of a compressing plant in the basement of the building, and the lamps are operated and controlled in much the same way as in Philadelphia.

The installation in Washington, D. C., consists of six 2-mantle lamps installed on 3 posts in front of the general offices, and 4 single mantle lamps installed on 2 posts in front of the sales department offices. The pressure is obtained by a compressor located in the basement, and the operation of the lamps and pilots is similar to that described above in the case of Philadelphia.

Des Moines, Ia., has 6 single-burner, high pressure, lamps installed on 3 ornamental curb posts. The pressure is obtsined from a compressing plant in the cellar, operated by a 2.5-horse power gas engine, which serves the double purpose of being an exhibit for the sale of gas engines as well as furnishing the power for the compressor. The method of operating the lamps and pilots is identical with those previously described.

The installation in Chicago consists of 40, single-mantle lamps, installed on brackets between the columns of the Peoples Gas Light and Coke Company's building. The lamps are operated on gas boosted to 2 pounds pressure, and to secure the increase in pressure on these units there has been installed in the sub-basement a duplicate booster set, consisting of two 4-horse power motors direct connected to 2 blowers. They are so connected as to eliminate the possibility of allowing the pressure to drop back to city pressure, inasmuch as the motors are connected to a specially constructed panel board arranged so that if one machine should stop from any cause whatever, the other machine is automatically thrown in and takes up the load.

The boosters will give a pressure of 5 pounds per square inch, but the gas is not delivered to the lamps at this pressure. A specially constructed governing by-pass is used, which by-passes the excessive amount of gas back through the booster again.

There are other systems on the market; one especially in which the air is delivered to the lamp under pressure—about 2 inches (5.08 cm.) of water—is extensively used; but, of course, in this case another pipe to each lamp is required. In these instances the efficiency will be practically the same as with the pressure gas lamps.

Since high pressure gas lighting has passed the experimental stage, and for a number of years has been so successfully operated in America, there is every reason to suppose that in the near future this form of lighting will be as prominent as either low pressure gas or electricity is to-day.

Deterioration of Gas Lighting Units in Service.

[Prepared by Mr. R. F. Pierce, for Sixth Convention, I. E. S.]

Deterioration, as applied in this instance, properly embraces only the results of such changes as are functions of time, and inherent in the apparatus used, the illuminant supplied and the conditions of use under the best modern practice.

Mantle deterioration is analogous to the deterioration in luminosity and efficiency of the filament of the electric incandescent lamp. The deterioration in illumination, due to deposit of dust upon the glassware, corresponds to the effects of the same cause upon glassware used with other illuminants, while such deterioration in candle power and efficiency, as may be due to fouling of the burner, has no analogue among other illuminants. The effects of varying gas conditions correspond to those of voltage fluctuations, but are of less importance, and come under the head of service factors rather than deterioration factors. There are no other variables of sufficient importance to require allowance or consideration in the design of gas lighting systems.

The test hereinafter reported was designed to separate the above factors with reference to the performance of gas lamps under different conditions of actual service. While it is rather difficult to completely separate the different influences with reference to their effects, this separation may be carried to such a point as to satisfy every practical requirement, and this test was conducted primarily for the purpose of obtaining engineering rather than scientific data.

Twelve inverted burners, selected at random from factory stock, were equipped with artificial fiber mantles similarly selected, and were adjusted for maximum incandescence by the eye alone, operating upon mixed gas (80 per cent. water and 20 per cent. coal) at 2.5 inches (6.35 cm.) pressure. The test was conducted in a room in

which the air was heavily charged with inorganic dust, to such an extent that a visible deposit settled over night upon newly cleaned surfaces.

Of the 12 units, 6 burned 24 hours daily, and 6 for 5 hours daily. Of each six, 3 had their cylinders cleaned at regular intervals and 3 were left untouched.

The cylinders of the continuous burning units were cleaned every 14 days, those of the intermittently burned units every 10 days. In addition to these units, 6 others, similarly selected, were burned continuously, 2 having bunsens cleaned every 500 hours; 2 every 1,000 hours; and 2 every 2,000 hours.

In all cases candle power and gas consumption readings were taken before and after each cleaning, the lamps being removed from the test bar to an Ulbricht sphere located on the floor below, and replaced after reading.

Fig. 1 shows the candle power life curves obtained from the test of

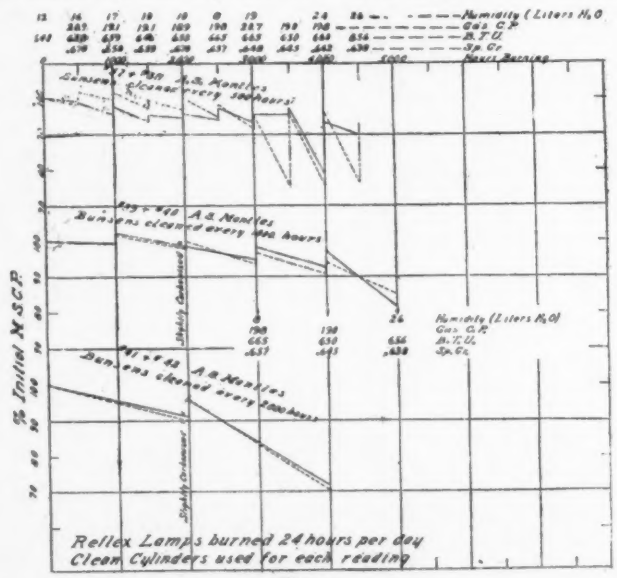

Fig. 1.

the second group of 6 units. The excessive burner deteriorations indicated at 3,500, 4,000, 4,500 and 5,000 hours were due to the omission of screens from the air ports and the advent of large numbers of insects which became deposited in the distributors of the lamps. Eliminating these abnormal results an average deterioration of 2.14 per cent. per 500-hour period is shown for units 37 and 38. Units 39 and 40 show an average deterioration of 2.6 per cent., per 1,000 hour period, and 40 and 41 show 5.35 per cent., per 2,000 hour period. Evidently, the greater portion of dust deposit in the burner takes place during the first 500 hours.

Figs. 2, 3 and 4 show specific consumption curves for the same

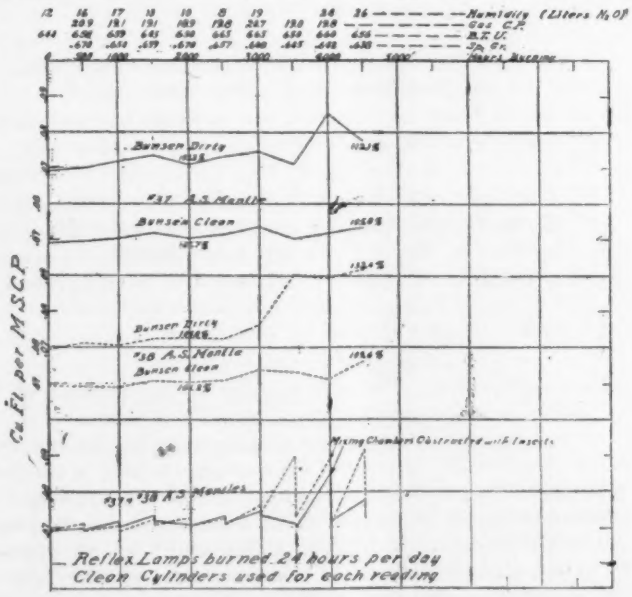

Fig. 2.

units. The curves marked "Bunsen clean" show the depreciation in mantle efficiency alone. It will be observed that the great variations in atmospheric humidity occurring did not affect the perform-

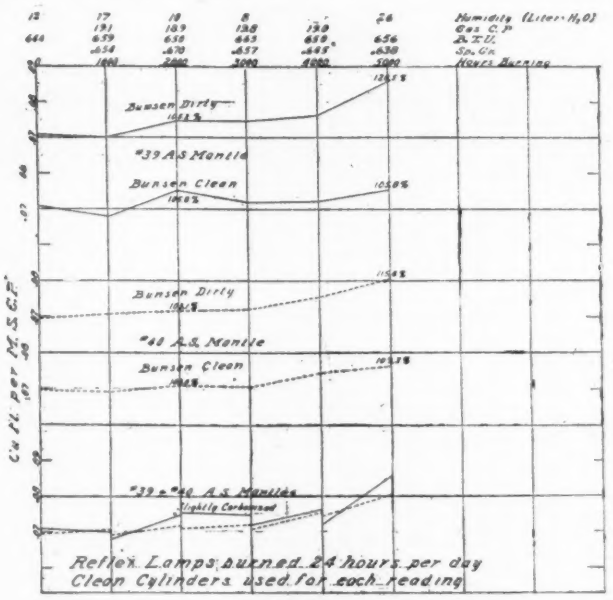

Fig. 3.

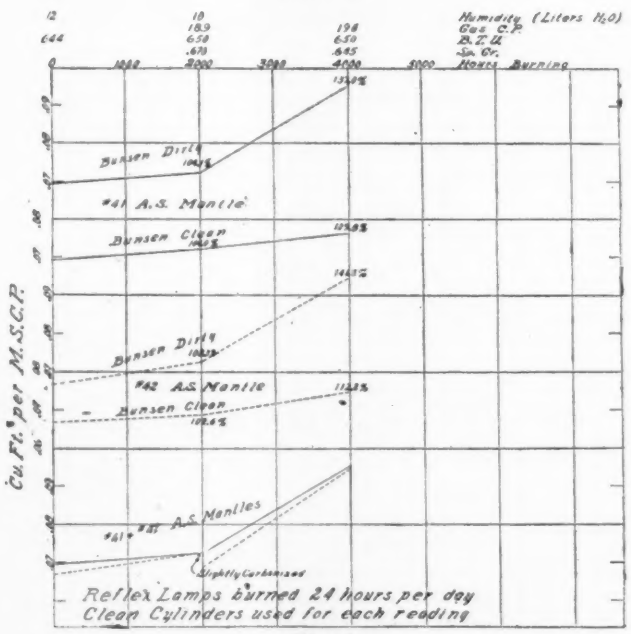

Fig. 4.

ance of the units to any noteworthy extent. At the end of the test the increases in specific consumption were 5.8, 10, 5.6, 8.5, 10 and 11.2 per cent., an average of 8.5 per cent. for a period of from 4,000 to 5,000 hours.

The effects of deterioration in glassware are shown in Figs. 5 and 6,

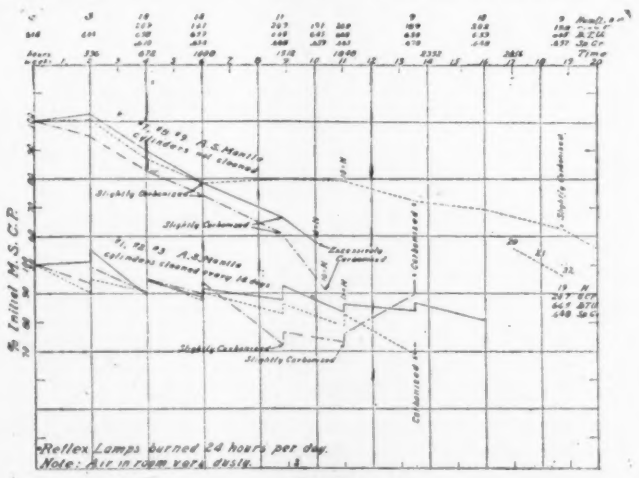
Time
% Initial M.S.C.P.
#1 to #9 Cylinders not cleaned
Slightly Carbonized
#1 to #9 A.S. Mantle cylinders cleaned every 14 days
Excessively Carbonized
Carbonized
Reflex Lamps burned 24 hours per day.
Note: Air in room very dusty.

Fig. 5.

from which maximum, average and minimum increases due to cleaning are found to be 6.4, 4.3 and 2.8 per cent. respectively, for the units burned 24 hours daily and cleaned every 14 days, and 6.3, 3.8 and 1.8

(*Continued on page* 234.)

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NEW YORK, MONDAY, OCTOBER 7, 1912.

[NOTICE.]

Tentative Programme, Seventh Annual Meeting, American Gas Institute.

According to the "Gas Institute News," dated October 1st, the programme (tentatively) for the Seventh Annual Meeting of the American Gas Institute, which is to be held in Atlantic City, N. J., Wednesday, Thursday and Friday, the 16th, 17th and 18th October, has been thus arranged:

Wednesday.—10 A.M. to 1 P.M.:
Address of Welcome.
Response.
Report Board of Directors (including the following reports from Committees, Regular and Special):
Technical; Membership; Secy.-Treas.; Finance.
President's Address.
Reports from Committees (Nominating; Wrinkles; Bureau of Information; Publication; Public Relations; Beal Medal; Arrangements; Affiliation.)

Wednesday.—8 to 10 P.M.:
"Public Service Commissions," by Mr. A. S. Miller.
Extracts from "Bulletin No. 32," Bureau of Standards.
Reports of Committees: (Calorimetry; Thermal Value and Candle Power; International Photometric Commission; International Uniform System of Pipe Threads; Consumers' Meters.

Thursday.—10 to 12 A.M. Section A.—Manufacture:
"Photometry of Incandescent Gas Lamps," by C. O. Bond.
"Effect of Various Diluents on the Candle Power of Oil Gas," by A. H. Elliott.
"Some Recent Developments in Gas Measuring," by E. C. Thomas.

Thursday.—10 to 12 A.M. Section B.—Distribution:
"Industrial Appliance Laboratory," by H. B. McLean.
"Utilization of Gas Appliances," Report of Committee on.

Thursday.—2 to 5 P.M. Section A.—Manufacture.
"State of the Art in Coal Gas Manufacture," by Mr. W. H. Blauvelt.
"Standardizing Carbonization Tests of Coal," Report of Committee on.
"The Value of a Weight Balance in Coal Gas Manufacture," by C. J. Ramsburg.
Thursday.—2 to 5 P.M. Section B.—Distribution:
"Small Unit Gas Engine,' by Carroll Miller.
"Effect of Cold Weather on the Gas Industry," by C.W. Andrews.

Friday.—10 A.M. to 2 P.M.
"Heat Balance in a Carbureted Water Gas Set," by O. B. Evans.
"Analysis of Water Gas Purification Material, and Determination of Tarry Matter in Water Gas Purification," by E. C. Uhlig.
"Allowed Strains in Gasholder Designs" (Committee Report).

Announcement: Committee of Arrangements.—Your most pressing duty this morning, in receipt of this copy of "The News," is to tear out the advance registration card, and mail it at once. Of course, you are going to the meeting, and we will find it easier to look after you, if we get your acceptance promptly. We do not expect your "regret," as we know you read the editorial in the September "News," which showed that non-attendance at meetings was fatal to your best chances in the gas profession. Also, you have been told enough about the paper and entertainment program[me] to know that pleasure as well as profit awaits you at Atlantic City. We have been very careful not to tell all we know about the entertainment features, because we do not want to spoil the fun that will begin at the start and keep up continuously until the end. Therefore, R. S. V. P., *P. D. Q.* The italics are ours.

[OFFICIAL NOTICE.]

Gas Meeters.

The 11th meeting of the Gas Meeters will be held Thursday, Oct. 10th, at 4 P.M., at the American Meter Co., 47th street and 11th avenue, New York, manufacturers of meters, calorimeters, photometers and provers. Plant in full operation.

Auto bus will make regular trips from the Subway, 50th street and Broadway, to 9th avenue L at 50th street, and to factory and return, beginning at 3:30 P.M.

Dinner at Mock's, 8th avenue and 46th street, 6 P.M. $2 per plate.

Mr. Walter H. Hinman will speak on Calorimeters and Gas Testing.

H. THURSTON OWENS, Secretary.

[OFFICIAL NOTICE.]

October Meeting, New York Section, Illuminating Engineering Society.

The October meeting, New York Section, Illuminating Engineering Society, will be held at Keene's Chop House, 70 W. 36th street, at 8 P.M. of Thursday evening, next. Two of the papers read at the recent convention will be repeated. The titles are: "Electric Lighting in Small Stores," by Mr. C. L. Law and A. L. Powell, and "A Symposium on High Pressure Gas Lighting," to be read by Mr. Geo. S. Barrows.—*ante*, p. 227. An informal dinner will be served at 6 P.M.

C. L. LAW, Secretary.

BRIEFLY TOLD.

MR. EDWARD C. JONES (beloved by all of us) at the San Diego convention last month, of the Pacific Coast Gas Association, was appointed the official delegate of the Association to attend the meeting of the American Gas Institute, in Atlantic City, next week. He is charged with positive instructions to invite the Institute to join the Pacific Coast Gas Association in persuading the other Gas Associations of the States in holding a Gas Congress in San Francisco during the Panama-Pacific Exposition in 1915. Mr. Jones will also be the bearer of credentials from the Panama-Pacific Exposition officials, abetted by an official invitation to the Institute to hold its 1915 meeting in San Francisco.

EDUCATIONAL WORK, N. C. G. A.—Mr. Louis Stotz, the indefatigable Secretary of the National Commercial Gas Association, is "on his way" through the States and Canada, during which trip he will have personally appealed to the employees of 22 of the largest gas companies, with a view to convincing the men that it will be decidedly to their advantage to enroll in the classes of the educational course that is being maintained by the Association. It naturally may be taken for granted that Secretary Stotz will first appeal to the executives of the companies, not only for their sanction of the plan of appealing directly to the men, but also to have the said executives advise the men that the plan has their direct advocacy.

"SPECIAL CAMPAIGNS."—We are indebted to the attention of Mr. W. H. Pettes, Chairman of the Public Service Gas Company (N. J.) Section of the National Commercial Gas Association, for the information that the first fall meeting of the Section was held in the Company's Newark headquarters the night of the 26th ult. The meeting was well attended, and the feature of the session was the discussion of a well-balanced paper on "Special Campaigns," which was contributed by Mr. G. E. Smith, of the Company's Jersey City branch. A second excellent communication was that read by Mr. A. W. Peardon, of the huge business hive in Paterson known as Quackenbush & Company. The theme was "Department Store Methods," and Mr. Peardon certainly treated it in such way that it caused a rousing discussion. This discussion, afforded the Public Service

Company's commercial men a rare opportunity of gaining intimate knowledge regarding the merchandizing methods followed by up-to-date shops or department stores. And all may rest assured that the Public Service men were not in any sense backward in asking questions.

CURRENT MENTION—

A PARTY (perhaps 20 in number) of distinguished European chemists, all of whom were delegates to the recently held international congress of applied chemistry, recently inspected (by special invitation) the Everett (Mass.) plant of the New England Coal and Coke Company. The visitors numbered several whose special branch is the production of coal tar derivatives, and to these the inspection proved especially interesting. The party was conveyed to the plant in one of the Company's tugs. and the inspection took 3 hours. On the return to Boston the visitors were the guests of Mr. C. L. Gagnebin, at a luncheon served in the dining room af the Algonquin Club.

MR. LOUIS R. CHRIEST has resigned from the office staff of the Northern Indiana Gas and Electric Company. He has arranged to take up life insurance work, and his headquarters will be in the South Bend (Ind.) offices of the Prudential Life Company.

MR. B. H. STRONG, formerly in charge of the gas and electric plants of the Baraboo (Wis.) Company, has been appointed Manager of the Antigo (Wis.) Gas Company, succeeding Mr. S. Smith, who comes to New York to join the staff of a well-known operating syndicate.

"B. V. B.," writing from San Francisco, under date of the 23d ult., says that the Board of Supervisors has reduced the rate which the Pacific Gas and Electric Company may charge for gas in that city to 75 cents per 1,000 cubic feet, equivalent to a cut of 5 cents. The Committee, in determining upon a rate, considered these prime factors: 1, cost of the product to the Company; 2, the value of the property actually in use and actually needed in carrying on the business; 3, the rate of investment return which should be allowed thereon; 4, an allowance for depreciation. The items which made up the rate properly chargeable for gas were thus decided by the Board: 1, cost of gas as produced, delivered and collected for, per 1,000 cubic feet, 45 cents; 2, investment returns, 24.418 cents; 3, for depreciation, sinking fund, 4.500 cents; a total of 73.924 cents. To provide for any further contingencies, the Supervisors allowed an additional 1.076 cents per 1,000 cubic feet, thus bringing the minimum charge allowable in San Francisco for the fiscal year, 1912-13, to 75 cents per 1,000 cubic feet.

MR. JAMES R. DALY, for nearly a half century connected with the New Orleans (La.) Gas Light Company, died at his home in New Orleans, the evening of Wednesday, the 23d ult. Deceased was in his 63d year, having been born in St. Mary Parish, La., September 12, 1850. His school tuition was gained in New Iberia, La., and at an early age he removed to New Orleans. In 1868 he entered the service of the New Orleans Gas Light Company, and in due time became the head of the Company's meter shops. He devised many things in connection with the manufacture and placing of meters, perhaps the most important of these being an automatic appliance for the oiling of diaphragms. He is survived by his wife, 8 daughters and 1 son. The funeral services were held in his late home, the morning of the 27th ult., and interment was made in Metairie Cemetery.

JUDGE E. E. BARNETT, of Opelika, Ala., has been granted a franchise for the construction and operation of a gas plant to supply the settlements of Opelika and Auburn, Ala. The maximum price that may be charged is $1.50 per 1,000 cubic feet. Builders of gas plants will do well to "get busy" on this Opelika account, for the people want gas and the Barnett syndicate is able to pay for all that it orders.

Remarkable Results in Pulmotor Practice.

[Communicated by MR. JAMES B. DOUGLAS.]

Remarkable results have followed the use in Philadelphia of the Pulmotor, the mechanical device for the resuscitation of unconscious persons, recently introduced in that city by the United Gas Improve ment Company.

Obtained primarily for the benefit of employees, and those of the general public who might suffer asphyxiation, the Company, shortly after the apparatus was installed, announced that the machines would be at the disposal of hospitals and physicians whenever and wherever required. Since that time the pulmotors, owned by the Company and kept ready for instant use in different sections of the city, have been in frequent demand, and several persons owe their lives to the prompt use of this wonderful apparatus. As soon as the Company is notified of the emergency, the pulmotor, and operator with tanks of oxygen, are sent to the desired point as fast as an automobile can carry them, all without charge.

One of the most startling results on record of the use of the pulmotor, is a case reported recently from the Frankford Hospital, Philadelphia, of the resuscitation of a man poisoned by the inhalation of nitric acid fumes. Recorded data of similar cases show that the patient is generally affected about 2 hours from the time of inhalation, death following within from 4 to 6 hours. It is said that heretofore no sure method of resuscitation for such cases was known to medical science.

In this case a wagon driver was engaged, about 5 P.M., in unloading a carboy of nitric acid when the base of the carboy broke and the fumes were inhaled. Symptoms of the poisoning developed about 2 hours later and the patient went to the hospital, Upon his admission his pulse was 42, respiration 4 per minute and his temperature subnormal. Other symptoms pointed to grave probabilities, but the patient did not suffer any serious discomfort until 9 P.M., when he became unconscious and delirious.

At 10:30 P.M. the patient, failing to respond to the regular methods of resuscitation employed, the hospital got into telephone communication with Mr. J. S. Parker, District Superintendent, and requested the use of a pulmotor, which was put in operation half an hour later. Mr. Parker, assisted by R. B. Duncan, another District Superintendent, operated the pulmotor.

From then on the patient's condition steadily improved, until finally, at 6:30 A.M., he was practically out of danger, except from the possibility of complications which, fortunately, did not develop.

Retorts. Which is the Better Type?

[By MR. A. J. ROBUS, St. Louis, Mo.]

The question of solid or segmental retorts is one that has been before gas men for many years, without any definite answer to the question, "Which is better?" being accepted.

Many and various are the arguments put forth on both sides. There are those who claim that, if an entire retort bench could be cast in one piece it would be so much the better. Some, however, claim that retorts made in larger segments will give better results, while others say that nothing other than the whole retort will do, believing that the joints in segmental retorts are sources of weakness, liable to open and form a key for the carbon deposit, and causing trouble and leakage when the retort is decarbonized.

Now, let us look at the retort bench from the gas manager's point of view. His chief interests, one might say his only interests, are "How long will it last?" "How much gas will it make?" and, "What will it cost to operate it?"

The writer has had considerable experience both in building and operating retort benches constructed of solid retorts; retorts constructed of large segments; and retorts constructed of small segments, both in this country and in England. And in his experience there is nothing else so durable or as efficient as retorts made in small segments, when properly built and put together.

The writer has seen retorts, built of small tongued and-grooved segments, stand up, in full working operation, for a period of 5 years without requiring repairs; and, in his opinion, this is chiefly due to the fact that these retorts, of small segment form, being flexible units, will, therefore, give-and-take with the expansion and contraction caused by the difference in the temperatures in the settings. Everyone who operates coal gas benches knows that the temperature cannot be kept perfectly even from end-to-end of the retort; also, that in heating a bench some parts of the retorts will get hotter quicker than others. Therefore, it is feasible to figure that uniform expansion or contraction, "Depending upon the quality of material in the retort setting," will not take place. Now, with a solid, one piece retort this causes cracks to show, and the works' superintendent complains of poor quality vessels.

With the retorts built of large segments, the usual complaint refers to distortions, making it difficult to remove the charge after carbonization. The retort built of small segments is extremely flexible, and yet, due to the tongued-and-grooved joint, no leakage is found, even after decarbonizing, and, if care is taken to see that the segments are hard-burned and true to shape when installing the bench, no trouble of carbon getting into the joints will be found, and decarbonization can be as easily effected as if it were a whole or one-piece retort, and no leakage will result. Segmental retorts require good and flexible supports, and nothing else is better for this purpose than the brick setting walls to support the retorts. The setting walls should be of the same quality material as the retorts, and these small-piece, segmental retorts can be made either of fireclay or silica material.

(Continued from page 231.)

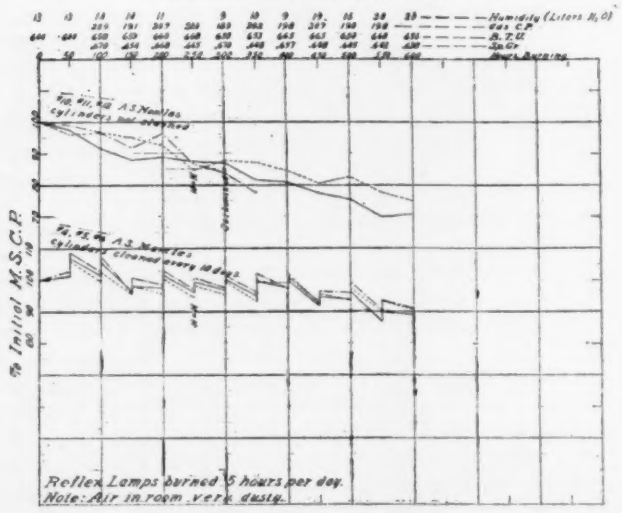


Fig. 6.

per cent. for those burned 5 hours daily and cleaned every 10 days. Evidently, the deposition of dust is a function of time and exposed surface, and is not greatly influenced by the burning of the lamp. This is further shown by a separate test conducted over a period of 21 days on gas and electric incandescent lamps. The results follow:

Inverted gas lamp, clean cylinder, burning, 4.2 per cent. loss.
Inverted gas lamp, clean cylinder, unlighted, 3.5 per cent. loss.
Average of four.
60-watt tungsten unlighted, 3.8 per cent. loss.
25-watt tungsten unlighted, 4.5 per cent. loss.
Average of two.

Figs. 5 and 6 show the relative effects of continuous and intermittent burning with reference to mantle deterioration.

Fig. 6 shows that the intermittently burned units with cleaned cylinders depreciated 7.16 per cent. in candle power in 600 hours; whereas, from Fig. 5 it appears that the average deterioration of continuously burned units in 672 hours was 5 per cent. The difference between the effects of continuous and intermittent appears to be negligible with this type of mantle.

A comparison of groups 1, 2 and 3 (Fig. 5) with groups 7, 8 and 9, shows that at the end of 1,000 hours the average depreciation of units with uncleaned cylinders was 23 per cent., while those with cleaned cylinders depreciated by .8 per cent.

The average increase per cleaning of the latter, as shown by the original data, was 4.6 per cent., or 13 8 per cent for 3 cleanings, making 21.8 per cent. for the corresponding deterioration had the three deposits of dust been superimposed and allowed to remain. This would indicate that up to 1,000 hours the deposition of dust is a straight-line function of time. At 2,700 hours, however, the uncleaned unit No. 8 had depreciated 31 per cent., while No. 7 had deteriorated but 14.5 per cent. Adding the aggregate increases due to cleaning to the latter gives 43.6 per cent. indicating that between 1,000 and 2,700 hours the rate of dust deposition decreases, probably due to the adhesion between glass and dust being greater than the cohesion between dust particles. After the lamps had been operated for some time, it was found that dust particles tended to collect in the bottom of the globe rather than to adhere to the side.

From the results of this test it was desired to evaluate the useful life of the mantle under operating conditions, and for this purpose specific consumption curves were plotted; these are shown in Figs. 7, 8 and 9. These curves include the effect of burner deterioration as it is not usual practice to clean burners, except when replacing mantles. The approximately parabolic form of the curve is probably due to the fact that burner deterioration is not a straight line function of time. Inspection of the curves shows that a parabola having the formula:

$y = \sqrt{2px}$ sufficiently approximates the form of the curve where
y = increase in specific consumption above the initial
x = elapsed time,
p = constant,
Let W = initial specific consumption.
T = total operating cost per c. p. hour at end of X hours,
A = cost of mantle per initial c. p.,
B = cost of gas per cubic foot.

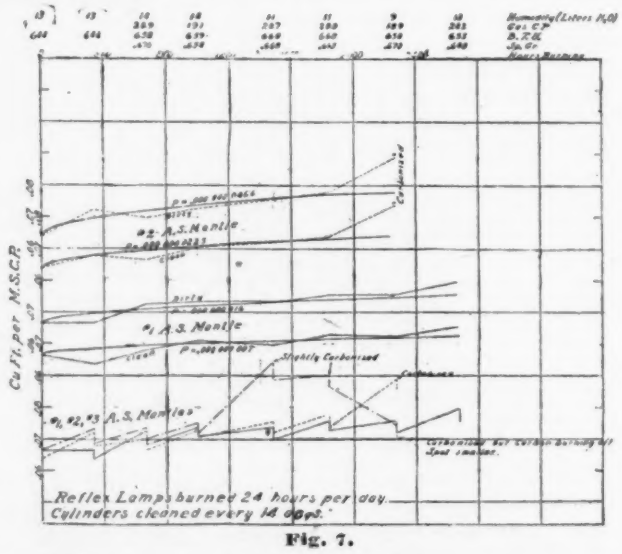


Fig. 7.

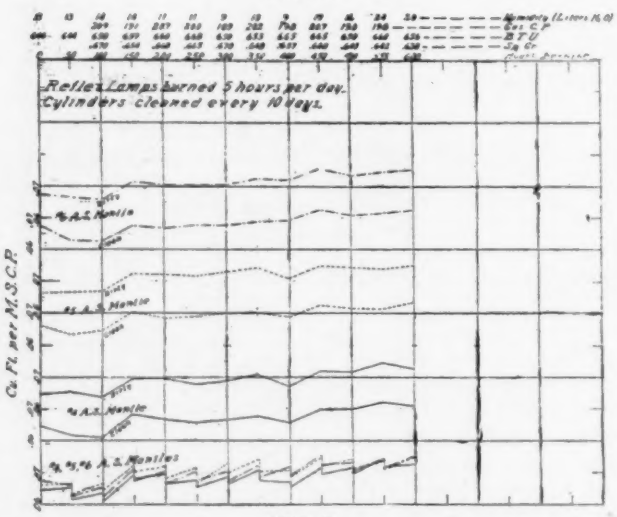


Fig. 8.

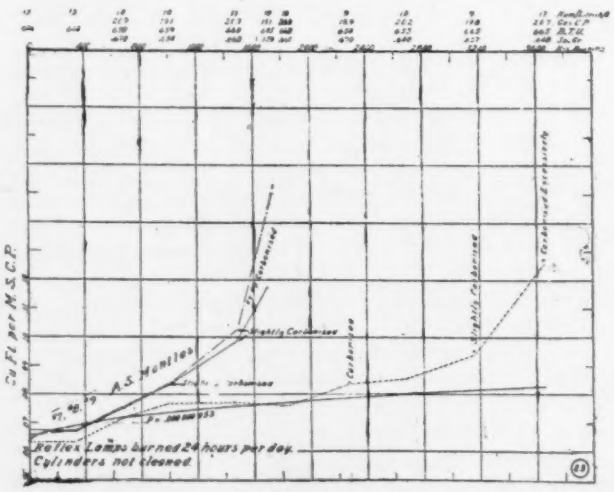


Fig. 9.

Then

$$T = A + \int_0^X B\sqrt{2px}\,dx + BWx$$

$$= A + \tfrac{2}{3}B\sqrt{2p}\,x^{\frac{3}{2}} + BWx.$$

The cost per c. p. hour is then

$$\frac{I}{x} = \frac{A}{x} + \frac{2}{3}B\sqrt{2p}\,x^{\frac{1}{2}} + BW.$$

which is a minimum when

$$Dx\left(\frac{I}{x}\right) = 0 = -\frac{A}{x^2} + \frac{\sqrt{2p}\,B}{3\sqrt{x}}, \text{ or when}$$

$$X = \sqrt[3]{\frac{9A^2}{2pB^2}}$$

Assuming $1 gas, and a mantle cost of 30 cents, the useful life of the mantles 1 and 2 is 2,650 and 1,750 hours, respectively, and that of

No. 8 (with uncleaned cylinder) 1,325. It is only fair to state that the mantles with which this test was conducted were an early product of lower efficiency than is now being obtained with the same rate of deterioration in candle power and efficiency. The present product has under the same circumstances about twice the useful life. The question of mantle mortality has been purposely avoided, as none of the mantles failed from mechanical causes.

The average minimum, maximum and mean initial candle powers and efficiencies were 54.8 minimum, 58.2 maximum, 57.8 average, and 14.96, 15.84 and 14.10, respectively, the average variation from mean candle power being 4.66 per cent.; and from mean efficiency 5.15 per cent., indicating that no allowance need be made for non-uniformity in initial mantle and burner performance.

The separate deterioration rates from different sources at the end of 1,000 hours continuous burning average as follows:

	Per Cent.
Mantle alone	2.5
Burner alone	2.5
Glassware alone	10.0
Total	15.0

These deteriorations were obtained under quite unfavorable conditions, especially as regards the dusty condition of the air, and there is no reason to believe that, under ordinary conditions of gas supply, there should be any difficulty in duplicating these results in average practise.

As far as the design of illumination is concerned, it is evident that there is no substantial difference between the performance of gas and electric units, and the quantities of illumination required and initially obtained by the one will be equally suitable for the other.

Report of Committee on Progress, Illuminating Engineering Society, Submitted at Its Sixth Convention.

The past year has been one of gradual and rather satisfactory progress in the science and art of illumination. No radical novelties in apparatus have forced their way to the front, nor has there been any startling innovation in methods; but it is gratifying to note that more attention has been paid to the proper installation of lamps, and the public has awakened to a fuller realization of the necessity of scientific methods in illumination.

Progress in Gas Lighting.—The most conspicuous advance in the material of gas lighting during the past year has been the extensive introduction of the artificial silk mantle. This material has shown itself capable of longer life and more uniform efficiency than any other thing yet tried as a material for mantles. A few inverted mantles of this type have been in use for some time past. This year they have been pushed into extensive use, and upright mantles of artificial silk, previously not available in this country, are now on the market. The inverted mantle has been of late rapidly replacing the older, upright mantle, on account of its better distribution for most purposes and its better qualities in other respects. This year, however, the increase of interest in indirect illumination has again brought the up right mantle to the front as having a more favorable distribution for indirect lighting than the inverted mantle.

The use of high pressure lighting has increased conspicuously abroad, but as yet few and small permanent installations have been made in this country. The interest in the subject has been awakened, however, and the number of experimental installations has been considerably increased. Appliances of high pressure lighting have been materially improved, so that there is good reason for paying more attention to this particular phase of gas lighting.

Among comparatively new uses of gas lighting, due to the availability of better and more powerful burners, can be mentioned the use of incandescent gas lamps by photographers, a comparatively recent innovation which has met with considerable success. The general efficiency of the mantle burners in commercial use has been the subject of improvement and, what is of greater interest to the public, the manufacturers have met the demand for a wider range of burner sizes; so that there are now on the market burners, of both the inverted and the upright types, of many different powers, consuming from as low as 1 cubic foot of gas per hour up to 7 cubic feet.

It should be noted that improvement in gas fixtures during the past year has been somewhat noticeable, and particularly to be commended is the adoption of a standard specification calling for a gas fixture of better and more uniform quality. Such a specification is now in the course of preparation by representatives of gas companies and fixture manufacturers. It is believed that it will be generally adopted and produce a salutary effect on the quality of these installations.

Electric Incandescent Lamps and Lighting.—The most important change of the past year in incandescent lighting has been the very widespread adoption of the drawn-wire tungsten filament. Tungsten wire can now be drawn of much smaller diameter than had previously been available; so that commercial tungsten lamps, of as low as 10 watts, have been produced which can operate successfully on a 110-volt circuit. The 15 or 16-watt size, however, is the smallest tungsten lamp in any considerable use as yet. The smaller tungsten units are already in growing use abroad and bid fair to become an important factor in certain classes of lighting. The larger tungsten lamps (up to 500 watts) have within the last year awakened a considerably increased demand in competition with both gas and electric arcs. On the Continent tungsten lamps, up to an even 1,000 watts, are coming into commercial use, but the largest of these sizes are still unusual.

The tungsten lamp as now used in this country remains at the same nominal efficiency as heretofore, but it must be noted that on the Continent 8/10-watt per candle is a specific consumption now very frequently quoted. This is based on the Hefner unit, and is, therefore, nearly 9/10-watt per candle, when based on the international candle. At this figure an economical life of 500 hours or more has been repeatedly claimed. It is naturally to be expected, therefore, that the lamps of manufacturers in this country are likely to be rated at a higher efficiency than now, since there is no reason to suppose that the American product is in any way inferior to foreign lamps.

We are glad to be able to report that there is some chance of a reduction in the size of the bulbs of tungsten lamps, possibly at slightly increased trouble from blackening; but, in view of possible better performance of the filament, still leaving a residual advantage to the user. The metallized filament carbon lamp has found its place for usefulness in the rapid replacement of ordinary carbon lamps for nearly all purposes. It is now available in all the shapes and sizes once familiar in the latter, with equally good life and materially higher efficiency.

Arc Lamps.—In this country the chief direction of advance in arc lamps has been toward the production of long-burning, flame lamps, which have been adopted on a considerable scale in Chicago and at some other points. A fairly economical lamp of this type, with an electrode life of 100 hours or more, has been produced by several manufacturers and gives good promise of usefulness where units of high power are necessary. There is, of course, danger that attempts to increase the electrode life may entail serious loss in efficiency, but the present indications are that the improvement in the quality of the electrodes has in a considerable measure met this difficulty. The tendency is to use electrodes mineralized practically throughout, instead of simply in a core of modest dimensions, carrying enough light-giving material to compensate in part for the longer time of burning per inch of electrode. The same tendency is active abroad and goes far to eliminate serious competition from the larger tungsten lamps by reducing the cost of operation of the arc lamps.

A 3 phase lamp, with 3 converging carbons, has been introduced abroad; it furnishes a very powerful light of remarkably low specific consumption, and is adaptable for circuits of frequency as low as 25 cycles per second. In this country the principal novelty is the so-called "Boulevard" type of magnetite arc lamp, which furnishes for spectacular illumination a unit of great power and efficiency extremely well suited to decorative purposes. This lamp is now used in a number of cities with admirable results. The titanium carbide arc, in an improved form, has been introduced for use on alternating current circuits, and gives new promise of general usefulness.

Finally, intensified carbon arc lamps, which have been pushed to a point of high efficiency, have been steadily coming into increasing use—well merited on account of their great regularity in performance and the admirable quality of their light where color discrimination is necessary. They are tending rapidly to displace the earlier forms of inclosed arc lamps which are now happily becoming obsolescent.

New Types of Illuminant.—The production of an artificial light capable of fully replacing daylight for color matching purposes has been a subject conspicuously to the fore during the past year. One type of intensified arc, with a carefully adjusted glass screen of a highly ingenious character, has come into use with good results. Two similar forms, based on tungsten lamps with colored screens, have also appeared. All three seem to produce pretty satisfactory results at, of course, a very much reduced efficiency. The use of the Moore carbon dioxide tube for the same purpose has increased. In

this category might also be placed the mercury vapor lamp with the rhodamine reflector. No device for obtaining daylight values of illumination sufficient to meet all the requirements of color discrimination has as yet been entirely satisfactory, all of those yet devised being open to criticism on theoretical considerations, though all are undoubtedly capable of great usefulness in meeting the trying conditions of this problem. It is fair to say that they do not vary among themselves more than the different conceptions of "white light" vary. It would be exceedingly interesting to see what could be done with mantle gas burners properly screened in meeting this requirement.

The most interesting of new iluminants from the theoretical standpoint is undoubtedly the neon vacuum tube lamp, developed in France, to which brief reference was made in the report of the Committee on Progress last year. Further details of its performance are now available. The rare gas neon, which forms a minor constituent of the atmosphere, can now be obtained in commercial quantities as a by-product of the preparation of liquid oxygen from air. The Paris works engaged in this industry even now can produce enough neon daily to fill 1,000 tubes of 1,000-candle power each if so many should be required. The ordinary tubes are of about 6 meters in length, and give about 900 spherical candle power. The power factor is about 0.8 and the specific consumption is 0.72 watt per mean, spherical, candle power at the terminals, or about 0.9 watt including transformer and inductive losses. The color of the light is extraordinary, being a beautiful orange, entirely lacking blue rays, just as the ordinary mercury vapor arc lacks red rays. No progress has yet been made toward the introduction of this interesting light into this country.

Finally, the quartz mercury arc lamps have made large progress within the past year. These lamps are not lacking in red rays, as is the ordinary form of mercury vapor arc, but are still subnormal in the red. It would be extremely interesting to know the result of operating them with the rhodamine reflector for a white light.

Results of Technical Research.—A considerable amount of work along physiological lines has been done during the past year both here and abroad. One of the results has been the suppression of the ultra-violet bugaboo by making it clear that, under the condition of practical illumination, natural or artificial, there is substantially nothing to be feared from ultra-violet radiation, in which the light of the sky, also that of several important commercial illuminants is somewhat rich. Another line of investigation directed toward the value of diffusion in illumination has furnished added evidence of its importance, not only in lowering the intrinsic brilliancy of all feasible sources, but also in reducing the reflected glare that is sometimes so serious an obstacle to vision.

Still another important addition to our knowledge lies in some of the photometric researches of the past year. Several of these have been directed toward the solution of some of the problems of heterochromatic photometry, with the general result of strengthening the position of the flicker photometer for such purposes, and incidentally of showing the limitations of the more ordinary photometric methods, and the devices by which they can be successfully applied to heterochromatic problems of the character usually arising in commercial photometry.

Important studies have also been made of the solution of photometric difficulties by methods eliminating the idiosyncracies of the eye through the use of selenium or other light sensitive cells. It has been shown, for instance, that for the selenium cell Talbot's law holds; and that within the bright part of the spectrum one can depend on a definite relation between the constants of the cell and the illumination, provided the latter be within determined limits. Curiously enough it is found that the constants of the cell vary so as to produce a species of Purkinje phenomena, the maximum sensitiveness lying in the yellow-green at very low illuminations, and in the red at very high illuminations.

There has also been a most ingenious attempt at producing a primary standard of light from incandescent platinum at the hands of two English investigators. A strip of platinum, electrically heated is held at a determinate temperature by the effect of the physical radiation filtered out through a water cell and a black fluorspar screen on a thermopile which indicates the radiant energy. The device was found to be good for a constancy within plus or minus ½ per cent., but whether it will prove any more workable in practise than various forms of the Violle standard remains to be seen.

New Auxiliaries and Sources of Business.—The line of reflecters of various sorts available for the illuminating engineer has been largely increased during the past year. The most notable change has been in the direction of indirect and semi-indirect lighting; the latter particularly has found numerous applications, and the line of suitable glassware has been largely increased, so that at the present time it is possible to obtain both indirect and semi-indirect lighting fixtures which are not only efficient but even decorative. As regards other shades and reflectors the principal changes have been in the direction of the improvement of metallic reflectors and their greater adaptation to meeting the requirements of the art of illumination, and in the production of well designed glassware of an ornamental character. The stigma placed upon the illuminating engineer, that he has persisted in recommending hideous shades and reflectors, bids fair to be permanently removed.

As regards increasing opportunities for use of light there has been a tremendous growth of so-called "great white-way" lighting, generally carried out as the result of the private enterprise of boards of trade or groups of merchants. Some of it is admirable from the standpoint of illumination; all of it ought to be. Unquestionably, its effect will be greatly to increase the amount of street lighting, whether permanently done at private expense or not. Illuminating engineers should use their best efforts when dealing with this class of work to make it so good from the standpoint of efficiency and artistic effect as to make it a permanent and growing branch of outside illumination.

In closing, it seems worth while in this connection to call attention to the efforts made last Fourth July to introduce spectacular and sensational electric lighting as a substitute for the customary fireworks. Those who are laboring to secure a "safe and sane" Fourth can hardly do better than to direct their energies toward satisfying patriotic young America with flamboyant and gorgeous civic fetes, rather than by spectacular conflagrations. How thoroughly this substitution can be effected is uncertain, but if carried out it certainly would decrease the activity of the firemen and the hospitals. Respectfully submitted,

GEORGE S. BARROWS,
PERCY W. COBB,
LOUIS BELL, Chairman,
} Committee.

Variation in Heat Units in Condensing and Scrubbing Coal Gas.

[Prepared by MR. A. I. SNYDER, for 21st Meeting, Michigan Gas Association.]

The paper presented to your Association last year, by Prof. Alfred H. White and Mr. R. S. Tour, on "The Function of Tar in the Condensation of Coal Gas," was more than interesting to most of us, especially, to those who have experienced an unusual degree of naphthaline troubles. The value of the paper as a money saver was appreciated, for it waved the danger signal to the desperate engineer who is groping in the dark for some source of relief. The purpose of this paper is not intended to throw any great amount of light upon any new methods of condensing and scrubbing, nor is it presenting anything really new to your Association, so far as the removal of naphthaline is concerned. It was mentioned last year, in the discussion on the paper above referred to, that in Grand Rapids they were scrubbing their coal gas with water gas tar. It will be understood that the removal of the tar fog was not necessarily the prime object of the water gas tar scrubber. The thing that was bothering Grand Rapids most was naphthaline trouble, pure and simple. It was the writer's good fortune to find that the greater part of such trouble had been overcome prior to his arrival in Grand Rapids.

I will not attempt to enter into detail in the description of the various pieces of apparatus used between the hydraulic main and the purifying boxes, but will briefly outline the treatment the gas receives between these two points in the works. The foul main connecting the hydraulic main to the exhausters, consists of 205 feet of 24-inch, cast iron, pipe exposed to an atmosphere in which there is a drop of approximately 25° F.—178° F. to 153° F. The foul main between the exhausters and the primary washer-cooler consists of 276 feet of 20-inch, cast iron pipe, exposed to the atmosphere in which there is a drop of approximately 15° F.—153° F. to 138° F. The temperatures of atmosphere on day readings were taken was 65° F. The primary washer-cooler is a Doherty washer-cooler, similar to those described by Mr. Blauvelt in a paper read before your Association (1910) on "The Washer-Cooler as a Gas Condenser." The primary washer-cooler used in Grand Rapids differs from the apparatus described by Mr. Blauvelt in that the circulating liquor and condensate, instead of settling in the liquor reservoir in the bottom of the condenser, and the tar drawn off periodically, are taken out of the condenser through a seal and overflow into a tar separator. The tar taken out of the gas in the washer cooler is separated from the circulating liquor and overflows from a point 6 inches above the bottom of the separator to the tar storage well. The suction of the circulating pump takes clear liquor from a point 12 inches below the top of the liquor in the last section of the separator. The surplus liquor, which represents that portion of the condensate in addition to the tar, overflows from the last section of the separator to the crude ammoniacal liquor well. Both the tar and the surplus liquor overflows are adjustable, so that any variation in the specific gravity of the tar and liquor can be periodically taken care of. The low baffles in the separator are sealed in tar, thus preventing the separator from allowing the entire overflow from the washer-cooler to be picked up by the circulating pump and discharged into the washer-cooler again. The primary washer cooler shell is 24 feet high by 7 feet 6 inches diameter. There are 36 sets of grids, made of ½-inch by 6 inch boards, spaced ½-inch apart. The rate of travel of gas through the washer-cooler is approximately 100 feet per minute. The amount of circulating liquor pumped depends upon the drop in temperature and tar removal desired. We can vary this from 50 to 150 gallons per minute. The P. & A. follows the primary washer-cooler.

At present the naphthaline wash-box is located between the P. & A. and the secondary washer-cooler. The naphthaline wash-box consists of an old submersion washer, 6 feet wide by 7 feet 4 inches long, by 6 feet high, in which the gas bubbles through 3 sections of water gas tar, semi-saturated with naphthaline. The gas enters the bottom section of the box on one side and leaves the top section on its opposite side. The water gas tar, which is circulated through the washer, enters the top section, overflows from one section to another, is taken out of the washer through a seal, and overflows into an overflow pot. The latter acts both as a separator and a mixer, and consists of a con-

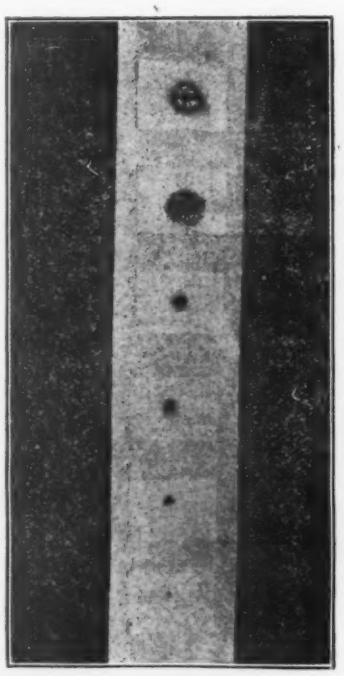
crete well, 2 feet 6 inches square by 4 feet 6 inches deep. There are 2 baffles dividing the well into 3 sections. The baffles extend from the bottom to the top of the well. One side of each baffle is tight against the wall of the well, thus causing a horizontal flow through the well. The overflow from the naphthaline wash-box enters in the corner at the top of the first section. The fresh water gas enters in the same corner of the first section as the overflow from the naphthaline wash-box, but is carried about half-way down into the well. The suction of the circulating pump is located at the bottom of the last section, diagonally opposite from the inlet of the overflow from the naphthaline wash-box and fresh water gas tar. The surplus in the overflow pot, which represents in quantity the fresh water gas tar used, is taken off the top of the last section diagonally opposite from the tar coming into the well. It is thus seen that, while we are using fresh water gas tar, the fresh water gas tar does not come in contact with the gas until it is pretty well mixed with the overflow from the naphthaline wash-box. The specific gravity of the overflow from the naphthaline wash-box is 1.0875; the specific gravity of the fresh water gas tar is 1.09; the specific gravity of the surplus from the overflow pot is 1.0875.

The secondary washer cooler and the ammonia scrubber, at the time the experiments were started, were practically the same apparatus described by Mr. Wm. Seymour in a paper read before your Association (1907), on "A New Method of Condensing and Scrubbing," except that the cooling coils are now similar to those described in the paper referred to above (by Mr. Blauvelt), and in the sections in the secondary washer-cooler, in which the travel is downward, the gas is not scrubbed. In the ammonia scrubber the gas is scrubbed in both ascending and descending sections, but there is no drop in temperature.

Plate No. I. shows a set of tar test papers taken by 10-second exposures. You will note the apparent reflected light on exposure No. I. caused by the deposit of heavy tar at the inlet to the primary washer cooler. Exposure No. II. shows very clearly that the heavy tar has been completely removed, but there remains a very large amount of tar fog at the inlet of the P. & A. Exposure No. III. still shows quite a large volume of tar fog at the inlet to the naphthaline wash-box. Exposure No. IV. shows almost as large volume of tar fog at the outlet of the naphthaline wash-box as at the outlet of the P. & A. How much of this tar fog is from coal gas or from water gas we have so far made no attempt to ascertain. Exposure No. V. shows quite a trace of tar fog at the outlet of the secondary washer-cooler. Exposure No. VI. shows a slight trace of tar fog still at the inlet to the purifying boxes.

Exposure No. I.	Primary Washer Cooler Inlet	Circulating Liquor Outlet	P. & A. Inlet,	Naphthaline Wash Box Inlet,	Secondary Washer-Cooler Inlet,	Ammonia Scrubber Outlet.
10 Sec. Exposure	Temp. 145°	Temp. 126°	Temp. 113°	Temp. 112°	Temp. 111°	Temp. 78°
	Pres. 25″	C. W. Temp. 72°	Pres. 25″	Pres. 22″	Pres. 17″	Pres. 15″

TAR TEST PAPERS.—PLATE NO. I.



TAR TEST PAPERS.—PLATE NO. II.

Exposure No. I.	Exposure No. II.	Exposure No. III.	Exposure No. IV.
Primary Washer Cooler Inlet	Circulating Liquor Outlet Temp.	P. & A. Inlet,	Naphthaline Washbox Inlet,
Exposure. Temp. 141°	Temp. 121°	Temp. By-passed	Temp. 104°
10 Sec. Pres. 21″	C. W. 73°	Pres. By-passed	Pres. 19″

Secondary Washer-Cooler Inlet,	Ammonia Scrubber Outlet.
Temp. 79°	Temp. 83°
Pres. 17″	Pres. 15″

PLATE No III.

TESTS ACROSS PRIMARY WASHER COOLER.

Test No.	Date	Time	Primary Washer Cooler Inlet Temp.	Primary Washer Cooler Inlet Pres.	Primary Washer Cooler Outlet Temp.	Primary Washer Cooler Outlet Pres.	Circulating Liquor Inlet Temp.	Circulating Liquor Outlet Temp	Circulating Liquor Gals. per Minute	Cooling Water Temp.	British Thermal Units Inlet	British Thermal Units Outlet	British Thermal Units Gain or Loss
1	7/16/12	1:30 p.m.	143°	26″	119°	25″	91°	——	——	——	614.0	610.7	—3.3
2	7/17/12	9:40 a.m	144°	25″	109°	24″	108°	——	——	——	598.0	603.5	+5.5
3	7/17/12	2:25 p.m.	145°	25″	107°	25″	108°	——	——	——	580.5	582.5	+2.0
4	7/22/12	4:30 p.m.	147°	29″	96°	28″	94°	120°	88	70°	624.5	630.0	+5.5
5	7/22/12	7:45 p.m.	142°	29″	96°	29″	92°	118°	84	70°	595.3	593.0	—5.3
6	7/22/12	9:15 p.m.	141°	28″	97°	28″	92°	118°	80	70°	610.3	602.5	—7.8
7	7/23/12	10:50 a.m.	142°	29″	101°	28″	98°	115°	86	70°	593.0	598.0	+5.0
8	7/25/12	5:05p.m.	144°	26″	102°	26″	102°	130°	62	72°	589.2	594.7	+5.5
9	7/25/12	8:20 p.m	137°	26″	115°	26″	106°	127°	58	72°	606.0	600.3	—5.7
10	7/26/12	10:10 a.m.	142°	26″	118°	26″	94°	132°	54	71°	628.3	625.3	—3.0

PLATE No. IV.

TESTS ACROSS P. & A. TAR EXTRACTOR

Test No.	Date	Time	Primary Washer Cooler Inlet Temp.	Primary Washer Cooler Inlet Pres.	P. & A. Inlet Temp.	P. & A. Inlet Pres.	P. & A. Outlet Temp.	P. & A. Outlet Pres.	British Thermal Units Inlet	British Thermal Units Outlet	British Thermal Units Gain or Loss
1	7/18/12	9:20 a.m.	143°	26.0″	109°	23.5″	101°	23.0″	627.3	618.5	—8.8
2	7/18/12	10:45 a.m.	140°	26.5″	101°	26.0″	100°	24.0″	616.3	616.3	0.0
3	7/18/12	1:45 p.m	142°	26.5″	102°	26.0″	101°	23.5″	602.5	502.6	—8.9
4	7/20/12	11:00 a.m.	136°	28.5″	91°	28.0″	90°	24.0″	620.0	612.5	—7.5
5	7/23/12	7:25 p.m.	140°	26.0″	102°	25.5″	101°	22.0″	589.7	585.3	—4.3
6	7/23/12	2:50 p.m	141°	27.0″	110°	26.5″	109°	23.0″	591.3	590.5	—0.8

PLATE No. V.

TESTS ACROSS NAPTHALENE WASH BOX.

Test No.	Date	Time	Primary Washer Cooler Inlet Temp.	Primary Washer Cooler Inlet Pres.	P. & A. Inlet Temp.	P. & A. Inlet Pres.	Naphthalene Wash Box Inlet Temp.	Naphthalene Wash Box Inlet Pres.	Naphthalene Wash Box Outlet Temp.	Naphthalene Wash Box Outlet Pres.	Water Gas Tar Circulated Gals. per Min.	British Thermal Units Inlet	British Thermal Units Outlet	British Thermal Units Gain or Loss
1	7/20/12	3:00 p.m.	126°	26.0″	86°	25.5″	85°	22.0″	84°	17.0″	7.0	610.3	604.5	—5.8
2	7/20/12	5:00 p.m.	125°	27.5″	87°	27.0″	81°	24.0″	81°	19.0″	6.0	600.5	600.3	—0.2
3	7/21/12	10:00 a.m.	143°	28.0″	88°	27.5″	83°	24.0″	83°	19.5″	7.6	601.0	591.5	—9.5
4	7/21/12	11:45 a.m.	143°	28.0″	81°	28.0″	80°	24.0″	80°	19.5″	7.2	628.3	613.5	—14.8
5	7/22/12	8:50 a.m.	146°	29.5″	92°	29.0″	91°	25.0″	90°	20.0″	6.8	896.7	801.0	—5.7
6	7/24/12	3:45 p.m.	147°	24.0″	108°	23.5″	106°	20.5″	106°	16.0″	7.4	638.6	618.9	—19.7
7	7/24/12	5:10 p.m.	144°	24.0″	110°	23.5″	109°	21.0″	107°	15.5″	7.6	633.3	627.3	—6.0
8	7/25/12	11:10 a.m.	145°	27.5″	106°	27.0″	106°	23.5″	104°	18.0″	7.4	551.7	547.0	—4.7
9	7/27/12	4:20 p.m.	146°	30.5″	120°	30.0″	115°	24.5″	114°	19.0″	9.6	632.3	623.3	—9.0
10	7/29/12	10:35 a.m.	146°	26.5″	114°	26.0″	112°	22.5″	109°	19.0″	7.2	592.0	585.5	—6.5
11	7/29/12	2:15 p.m.	145°	25.5″	113°	25.0″	112°	21.5″	110°	18.0″	7.4	610.7	610.3	—0.4
12	7/31/12	2:05 p.m.	142°	25.0″		24.5″	100°	21.0″	98°	18.5″	7.1	636.0	634.0	—2.0

NOTE: Average loss in B. T. U's on Tests, No. 1, 2, 3, 4, = 7.6 B. T. U.
Average loss in B. T. U's on Tests, No. 5, 7, 8, 10, 11, 12, = 4.9 B. T. U.
Average loss in B. T. U's on Tests, No. 9, 10, 11, 12, = 4.5 B. T. U.

PLATE No. VI.

TESTS AT OUTLET OF SECONDARY WASHER COOLER.

Test No.	Date	Time	Primary Washer Cooler Inlet Temp.	Primary Washer Cooler Inlet Pres	Secondary Washer Cooler Outlet Temp.	Secondary Washer Cooler Outlet Pres.	Temp. of Atmosphere	British Thermal Units Unscrubbed	British Thermal Units Scrubbed	Gain or Loss
1	7/29/12	4:30 p.m.	144°	16.5″	106°	16.0″	80°	617.0	605.5	—11.5
2	7/30/12	9:05 a.m.	101°	20.0″	101°	19.5″	74°	591.5	577.0	—14.5

Plate No. II. shows a set of tar test papers taken in the same manner as those in Plate No. I. Exposures Nos I. and II. show practically the same conditions as in Plate No. I. Exposure No. III. shows that, with practically the same condition existing in the secondary washer-cooler, but with the P. & A. and the naphthaline wash-box by passed, the volume of tar fog present at the outlet of the secondary washer-cooler is substantially the same as at the outlet of the P. & A. Exposure No. IV. shows a much larger volume of tar fog entering the purifying boxes. The efficiency of the secondary washer-cooler as a tar extractor, while very apparent, is not what was expected. Upon investigation it was found that the settling reservoirs in the

PLATE No. VII. NAPTHALENE TESTS.

Test No.	Simultaneous Tests Across Apparatus	Date	Time	Primary Washer Cooler Inlet Temp.	Primary Washer Cooler Inlet Pres.	P. & A. Inlet Temp.	P. & A. Inlet Pres.	Naphthalene Wash Box Inlet Temp.	Naphthalene Wash Box Inlet Pres.	Naphthalene Wash Box Outlet Temp.	Naphthalene Wash Box Outlet Pres.	Naphthalene Removed Mg. Per Cu. Ft. Inlet	Naphthalene Removed Mg. Per Cu. Ft. Outlet	Naphthalene Removed Percent.	Naphthalene Wash Box per Cent. Removed
1	P.W.C.	7/18/12	9:30 a.m.	143°	26.0"	102°	25.5"	101°	23.0"	98°	17.5"	13.5	11.7	7.5%	
2	P.W.C.	7/19/12	3:00 p.m.	140°	28.0"	109°	27.5"	108°	24.0"	106°	18.5"	16.0	14.4	10. %	
3	P.W.C.	7/20/12	10:40 a.m.	136°	28.5"	91°	28.0"	90°	24.0"	89°	19.0"	28.6	23.9	19.4%	
4	P.& A.	7/21/12	9:30 a.m.	142°	28.0"	85°	27.5"	85°	24.0"	85°	19.5"	41.8	36.5	12.7%	87.3
5	P.& A.	7/21/12	4:30 p.m.	145°	28.5"	101°	28.0"	101°	25.0"	100°	20.0"	39.4	32.8	16.7%	83.3
6	P.W.C.	7/22/12	4:00 p.m.	146°	28.5"	98°	28.0"	97°	24.0"	97°	19.5"	34.5	27.6	20. %	
7	P.& A.	7/23/12	8:00 p.m.	140°	28.0"	100°	23.5"	99°	23.0"	99°	17.5"	34.6	27.1	21.4%	78.6

NOTE.—Outlet of Napthalene Wash Box on tests, No. 4, 5, 7, showed only very slight trace of Napthalene.

base of the secondary washer-cooler were entirely inadequate to permit the by-passing of the P. & A. and naphthaline wash-box for any great length of time.

Plate No. III. shows comparative B.T.U. tests across the primary washer cooler; samples were taken simultaneously. The variation in temperatures at the outlet, from 96° F. to 119° F., was intentional. The temperature at the outlet of the primary washer-cooler was carried as low as 80° F., but comparative tests on B. T. U's across the P. & A. and the naphthaline wash-box, showed that, at temperatures below 100° F., the loss in B. T. U's was prohibitive of such practice. You will note that, although there is a rather wide variation in the results, the grand average of the entire set of tests shows no loss in B. T. U's across the primary washer-cooler. The variation in the results is partly explained by the difficulties encountered in taking the samples, as well as in the fact that there is an unusually large amount of tar fog at both the inlet and the outlet of this piece of apparatus.

Plate No. IV. shows comparative B. T. U. tests across the P. & A. Samples were taken, the same as in Plate No. III.; but you will note there is still quite a variation in the results; although the variation does not extend over as wide a range. The conditions across this piece of apparatus are much better for experimental work than across the primary washer-cooler. The loss in B.T.U's, as you will note, was 5.2.

Plate No. V. shows comparative B. T. U. tests across the naphthaline wash-box. Samples were taken, same as above. The variation in the results obtained across this piece of apparatus are caused by a number of different conditions, some of which we have overcome.

Test No. 2 shows that, at a temperature of 81° F., there is practically no loss in B. T. U's This is accounted for as follows: The sample was taken at 5 P.M. The water gas tar supply tank, at the time this test was made, was arranged to feed fresh water gas tar direct into the suction of the circulating pump. The suction of the circulating pump was connected direct to the bottom of the naphthaline wash-box. The water gas tar supply tank, which is filled periodically, was filled on this particular day at 5:30 P.M. On account of the difficulty in maintaining a uniform feed of fresh tar with this arrangement, the circulating pump had no doubt been sending thoroughly saturated water gas tar through the wash-box for some time. Had a test been made for a trace of naphthaline at the outlet of the wash box, at the time this sample was taken, we would have found the wash-box to have been doing no work whatever.

Test No. 6 shows a condition just the reverse of that in test No. 2. The sample in this case was taken just after the supply tank had been filled, and the temperature was what was considered about the proper temperature at which to operate the piece of apparatus. However, the drop in B. T. U's was 19.7.

July 27th, 1912, the overflow pot on the naphthaline wash-box (as described above) was put into commission. Test No. 9 shows a drop of 9.0 B. T. U's. The sample for this test was taken only a short time after the supply tank had been filled. Test No. 11 shows a drop of 0.4 B. T. U's. The sample for this test was taken only a short time before the supply tank had been filled. The variation in these results exemplifies the attention that this piece of apparatus requires. We have installed, between the supply tank and the overflow pot in the fresh water gas tar line, a regulating device which now works very nicely and keeps the conditions referred to above under control.

The drop across the naphthaline wash-box, at temperatures from 80° F. to 85° F., was 7.5 B. T. U's, as shown in Plate V. On account of the amount of coal tar fog entering the naphthaline wash-box it was thought the drop in B. T. U's at these temperatures could be partly accounted for. Tests were, therefore, made at the outlet of the secondary washer-cooler, with the P. & A. and naphthaline wash-box by-passed. Two samples were taken in each test. One sample was passed through a train of bottles in which the gas was bubbled through water gas tar, and the water gas tar used was taken from the overflow pot of the naphthaline wash-box. The temperature of the gas in the main at the outlet of the secondary washer-cooler was the same as that of the atmosphere, so that no jacketing of the sampling tubes and wash-bottles was necessary. Plate No. VI. shows the results of these tests. An average drop of 13.0 B. T. U's was conclusive evidence that, at temperatures around 80° F., the scrubbing of coal gas with water gas tar is prohibitive.

Simultaneous tests were made across the primary washer cooler and the P. & A. to determine the percentage of naphthaline removed in these pieces of apparatus. The wide variations in the results are due to varying conditions in the retort house, caused by sudden changes in the weather and heavy rains, together with varying quality in the coals used, thus affecting the heats in the benches. The results, while apparently not consistent, show approximately the amount of naphthaline removed before the gas enters the naphthaline wash-box. Numerous tests have been made at the outlet of the naphthaline wash-box, under almost every conceivable condition for a trace of naphthaline. The results of these tests have been very gratifying, for, with few exceptions, the amount of naphthaline has been so small that we felt no ill effects whatever. In conclusion, the primary washer-cooler as a condenser shows great efficiency with no loss in B. T. U's.; the P. & A. could be by-passed to great advantage, if it were not for the present type and location of the naphthaline wash-box; and the naphthaline wash-box is well worth the loss in B.T.U's, together with the necessary attention it requires.

The general information received through our experiments indicates to us that we might be able to utilize our secondary washer-cooler to a much greater advantage. Instead of using all of the 8 sections as a secondary condenser, we might be able to use, say, the first one or two sections to remove coal tar fog with no drop in temperature. The third and fourth sections could be used to remove naphthaline by circulating water gas tar in the same manner as liquor is used in the washer-cooler. The fifth and sixth sections could be used as a secondary condenser, and the seventh and eighth sections could be used to remove the last traces of tar fog, thus affording great efficiency in the ammonia scrubber and less pressure in the purifying boxes. The feasibility of this arrangement we expect to determine with further experiments, using a miniature washer-cooler under different conditions at the inlet and outlet of each section of the secondary washer-cooler.

Items of Interest
FROM VARIOUS LOCALITIES.

THE Ottawa Banking and Trust Company informs us that its report, as Receiver of the Mendota (Ills.) Gas Company, dated July 1, 1912, was approved the 14th ult., and, in compliance with an order then entered, the Receiver filed its supplemental (and final) accounting as of the 23d ult. Accordingly the Receiver was ordered to turn over to the purchasers of the property, at the Masters' sale (Messrs. J. R. Woods, A. G. Griggs and F. A. Meidinger, as Trustees) all personal property and effects of every kind and character, which as such Receiver it had employed and acquired, in the operation of said plant, including stock on hand, etc., and thereupon it be relieved from the further operation of the plant. The cash balance on hand (amounting to $4,625.27) to be retained by it until the further hearing and order of the Court.

MR. JAMES RAGAN DALY, foreman of the meter repair shop of the New Orleans (La.) Gas Light Company, and in the service of that corporation since 1867, died the evening of the 25th ult. He was much esteemed.

"R. J. A.," writing from St. Louis, Mo., under date of the 27th ult., says that the Laclede Gas Light Company, having experimented with silica retorts, segmental type, for sometime, has placed an order with the Evans & Howard Firebrick Company for 10 benches, 8 retorts each, to be constructed in accordance with the Evans & Howard Company's special small segmental design. These settings are to be of the full-depth recuperative order, the furnace being on one side only. The retorts are to be 16 inches by 26 inches in section, and 20 feet in length. The builders claim that with the small segments a thoroughly flexible and durable retort is obtained.

DR. ROBERT H. FERNALD has been appointed Professor of Mechanical Engineering, University of Pennsylvania, vice the late Dr. H. W. Spangler.

"V. M. W.," writing from Alton, Ills., under date of the 27th ult., says that advices from Evansville, Ind., are to the effect that the plant recently built at Edwardsville, Ills., by Mr. F. W. Freese, of Fort Wayne, Ind., at the instance of the Peckinpaugh-Dannatell syndicate, has been purchased by the St. Clair County Gas Company, of East St. Louis, Ills. Mr. Henry C. Quackenbush, of East St. Louis, will be the Company's Manager.

THE Supervising Architect, Treasury Division, Washington, D. C., will receive bids, until October 21 and 29, respectively, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures and approaches), of the United States Post Offices at Moorhead, Minn., and Elberton, Ga. Copies of drawings and specifications may be obtained of the Custodians of Sites, or directly from the Supervising Architect.

SEVERAL times this summer and fall the Meriden (Conn.) Cutlery Company has been obliged to develop its power by putting at work its 200-horse power gas engine, through the failure of Hanover Pond to yield sufficient flow to operate either of the Cutlery Company's water wheels.

"L. B. B.," sends this from San Francisco, under date of the 22d ult.: "With exceeding regret I inform you of the death of Mr. James H. Wise (in Merritt Hospital, Oakland, Cal., Sept. 16th), since 1905 Assistant General Manager, the Pacific Gas and Electric Company. Sunday evening (15th Sept.) while touring in a travelling auto-car, in company with Mr. P. M. Downing and 3 assistants electrical engineers, making an inspection tour of the Company's conduits in the Bakersfield section. Just as the party turned homewards towards San Francisco (the hour was perhaps 4:30 P.M.) something went wrong with the radiator. It was found that the gasoline tank was leaking. Hardly had the fact been made known when a slight explosion (Wise carried a lighted lamp) occurred. His clothing was more or less saturated with the leaking fluid, and instantly he was enveloped in flame. Before the latter could be beaten out he was terribly burnt about the lower part of his back and sides. The machine was found undamaged and, the leak repaired, Wise, unconscious, of course, was placed in the car which was driven at full speed to Bakersfield. At that point he was placed aboard a train, reaching the Oakland depot at 8 P.M He was at once removed to the Merritt Hospital, where every possible effort was made to save him; but without avail. He recovered consciousness (more's the exceeding pity) 3 or 4 hours prior to the end. James H. Wise was a graduate of the Engineering College, California State University (Class 1903), having in 1900 graduated from the Alameda High School. The family (he was a son of the late James and Clara E. Wise) who in 1887 removed from Denver, Col., to Alameda, later on removing to Berkeley, Cal. Having finished his College work deceased became attached to the engineering department of the Pacific Gas and Electric Company, where his promotion was rapid. He supervised the construction of the Company's plant at Lake Spaulding, and was qualified and equipped to accept any task that could be assigned him. He was often called on to speak at the University on engineering problems, and was greatly esteemed by his fellows. He was a valued member of the Pacific Coast Gas Association, and was prominent in Pacific Coast Masonic circles. The funeral services were held the afternoon of the 19th ult., in the local Masonic Temple, Berkeley, Cal., under the direction of Durant Lodge, of which body he was a prominent member."

MR. W. H. MATLACK, JR., formerly connected with the St. Claire County Gas and Electric Company, East St. Louis, Ills., has been appointed Assistant to Mr. T. L. Marshall, Manager, Henrico County Gas Company, Richmond, Va. The Henrico County Gas Company, among other properties, controls the Company at Barton Heights, Va.

ADVICES from Milwaukee, Wis., are to the effect that Mr. J. D. Mortimer, President of the Racine (Wis.) Gas Light Company, during a recent conversation with a reporter of the Milwaukee (Wis.) *News*, remarked that a plan for the consolidation of the Racine and Kenosha gas and electric light utilities, for the purpose of reducing the problem of management and obtaining money for construction purposes, was being considered. In commenting further on the proposition, Mr. Mortimer remarked: "The properties of the Companies are so located as to readily make possible the construction of a unified property. In fact, the gas plants in Racine and Kenosha are connected by a high pressure line, and part of the gas used in Kenosha is made in Racine. The consolidation, in respect of operating the plants, will be a distinct advantage to both the Companies and the public. The outstanding capital stock of the Racine Gas Light Company is $500,000, and it is proposed to increase this to $1,200,000. The increased capital stock will be used in part payment for the properties of the Kenosha Gas and Electric Railway Company, and partly for obtaining assets by the sale of said stock for cash at par. The new securities to be issued are to be put on the market in accordance with rulings issued by the Railroad Commission of Wisconsin."

THE residents of Rock Hill, S. C., are evidently anxious to have a gas supply, for the Executive Committee of the Chamber of Councilmen has appointed Messrs. J. M. Cherry, C. L. Cobb and W. B. Wilson, Jr., a committee to draft a suitable franchise for the operation there of a gas plant.

"P. B. B.," writing from Baltimore, Md., under date of the 28th ult., incloses the following summary of the report of President J. E. Aldred, President of the Baltimore Consolidated Gas, Electric and Power Company, to the shareholders, which report has to do with the operations of the corporation for the fiscal year ended June 30, 1912. The document, which will be read to the proprietors, assembled in annual meeting to-day, shows the past year to have been an exceptionally prosperous one, substantial gross and net income gains being shown as against the returns for 1911. The income account appears like this:

Gross income	$5,465,287.18
Operating expenses and taxes	2,642,887.40
Net earnings	$2,822,399.78
Fixed charges	1,417,267.86
Net income	$1,405,131.92
Dividends paid and payable	744,749.96
Surplus	$660,381.96
Reserve for renewals, amortization, etc.	455,526,64
Net surplus	$204,855,32

The report further states: "The gross income, as compared with the previous fiscal year, shows an increase of $597,510.52, or 12.3 per cent., and the net earnings show an increase of $410,063.38, or 17.0 per cent. The business of both the gas division and the electric divisions have continued to expand, the gas output showing an increase of 8 per cent., and the electric output an increase of 43.6 per cent., as compared with the previous fiscal year. In order to meet the rapidly increasing use of gas and electricity, and to anticipate future requirements, expenditures during the year for extensions, improvements and betterments of the Company's facilities, completed and in course of completion, amount to $1,364,703.04, distributed as follows: Gas division, $564,420.10; electric division, $800,282.96. The physical condition of plants and distributing systems of both divisions of your Company has been fully maintained by the expenditure for ordinary repairs and maintenance of $309,935.57, or 5.7 per cent. of the gross income. In addition to this expenditure there has been set aside out of earnings for the fiscal year a reserve for renewals, amortization, etc., amounting to $455,526.64."

THE New York State Land Board, sitting in Albany, the 26th ult., was obliged to postpone the hearing in the matter of the application of the Cohoes Gas Light Company for a certain grant of land under Cohoes Falls, the same to be used in connection with its power generating system. The hearing was postponed to the 9th inst., owing to the failure of W. E. Wertime, Attorney for those in opposition, to make an appearance.

THE corporate title of the new Gas Supply Company, of Zanesville, O., has been amended so as to read the "Zanesville Gas and Electric Company."

ON the 15th inst. Messrs. Murray and O'Laughlin will appear before the Governor of Pennsylvania, and make application for a charter to enable the Lawrence Township Gas Company to manufacture and supply gas for heat and fuel in Lawrence Township, borough of Clearfield county, Pa. The people in interest are Messrs. Warren Partridge, F. E. Taylor and James P. O'Laughlin.

"T. V. M.," writing from Muncie, Ind., under date of the 28th ult., says: "We all knew long, long ago, that Mr. F. E. Tracy, of the Central Indiana Gas Company, was a versatile chap; but not everyone knew that he was a spellbinder of the most pronounced sort. But that he is an orator 'sure enough' I can vouch, that knowledge having been forced upon me through having listened to an address by him before the Normal City Commercial Club, of Muncie, Ind., the evening of last Friday. His theme was 'Gas and Gas Supply,' and his intelligent, pleasing way and manner of putting the different phases of his subject before an exceptionally well-qualified-to-listen audience, were enjoyed by everyone present. Yes; including myself. And I've been actively in the gas business for 30 years."

THE Citizens Gas Company, of Madison, Ind., has removed to office quarters on East Jefferson street, much better suited to its growing needs on such account than those heretofore occupied. The arrangement of the new headquarters includes provision for a gas appliance showroom.

THE Wildwood and Holly Beach (N. J.) Gas Company is proposing to put in a gas main between Tuckahoe and May's Landing, and from the latter to Down's Town. If the authorities acquiesce, this main will yield a gas supply to the residents of the intervening settlements of Hawkinsville, Estelville, May's Landing, Mizpah, Richland, Beuna and Landisville, to say nothing of the farmers who live along the route in the many gaps between the places enumerated.

The Market for Gas Securities.

The quotation in respect of Consolidated gas to-day is identical with that of the figures for last Friday—147¼ to 147½. The Company is making its product at figures which certainly are reflecting much credit on the perspicacity of its engineering force. Things are not done in any half-hearted or crack brained way in Astoria, and if prediction were made 20 years ago that a gas concern would be doing 20 years later that which is being done on the extreme northwestern end of Long Island to-day, he would be voted a fit candidate for Doctor-Congressman Kindred's Sanative, Astoria station, known as River Crest.

The Brooklyn Union situation remains in hazy state, and although no transactions have been recorded in it of late, the nominal values are fairly well maintained. The quotation is 145½ to 147. Peoples, of Chicago, keeps going along smoothly, and although the gains each week are usually less than a point, nevertheless that gain is evenly maintained. Lacledes show no change.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

OCTOBER 7.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$78,177,000	100	147 4	147½
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	8,000,000	1,000	108	108
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	3,500,000	100	182	187
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	101	102½
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98¼	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	95	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	99½	101
Standard	5,000,000	100	60	70
Preferred	5,000,000	100	90	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	146½	147
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106¾	107
Yonkers	299,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	⅝	⅛
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47¾	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,000,000	1,000	104	106¼
Cincinnati Gas and Electric				
Co.	29,500,000	100	87	90
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. &				
Heating Co.	1,682,750	100	90¼	91
Preferred	3,026,500	100	75¼	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	13,460,084		—	—
Mortgages, 5's	3,400,000		—	—
General Mortgage 4½	10,661,000		—	—
Con. Gas Co., Baltimore				
City, 4½	2,751,000		—	—
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,580,000	—	—	50
Detroit Gas Co., 5's	381,000	1,000	75	80
" Prior Lien 5's	5,619,000	1,000	97	100½
Equitable Gas & Fuel Co.,				
Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	183	186
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,250,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	130	133
" Bonds, 5's	10,500,000	—	104	106
Indianapolis	2,000,000	—	38	45
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	91	95
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	98½	99
Laclede Gas Co., St. Louis.	10,000,000	100	105½	106
Preferred	2,500,000	100	99	102
Bonds	10,000,000	1,000	102⅝	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	120	120
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	
Massachusetts Gas Companies, of Boston	25,000,000	100	94	94¼
Preferred	25,000,000	100	95¼	96
Montreal Gas Co., Canada	2,000,000	100	233	236
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	5,000,000	25	182	190

DIVIDEND NOTICE.

AMERICAN LIGHT AND TRACTION CO.,
40 WALL STREET, NEW YORK CITY, Oct. 1, 1912.

The Board of Directors this day declared from the net earnings of the Company the regular quarterly dividend of one and one-half per cent. (1½ per cent.) on the preferred stock of this Company, payable Nov. 1st, 1912, to stockholders of record of preferred stock at the close of business Oct. 16th, 1912. The Board also declared, from the undivided profits of the Company, a quarterly dividend of two and one-half per cent. (2½ per cent.) on the common stock of the Company, payable Nov. 1st, 1912, to stockholders of record of Common Stock at the close of business Oct 16th, 1912. The Board also declared, from the undivided profits of the Company, a dividend of two and one-half (2½) shares of common stock on every one hundred (100) shares of common stock outstanding, payable Nov. 1, 1912, to stockholders of record of common stock at the close of business Oct. 16th, 1912. The transfer books for both preferred and common stock will close Oct. 16, 1912, at 3 o'clock P.M., and will reopen Nov. 1, 1912, at 10 o'clock A.M.

1948-1 C. N. JELLIFFE, Secretary.

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October 16 to 18, 1912. Marlborough-Blenheim Hotel, Atlantic City, N. J. Officers: President, Ira C. Copley, Aurora, Ills. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting Sept. 1913. Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 9, 1912. Officers: President, R. M. Searle, Rochester, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street. New York City.

Gas Meters.—Next meeting, Oct. 10. Chairman, Will W. Barnes; Commissioners, W. H. Pettes, L. W. Peffy; Secretary, H. Thurston Owens, 42 Pine street, New York City.

Guild of Gas Managers of New England.—Annual meeting, March, 1913. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, March 19th and 20th, 1913. Chicago, Ills. Officers: President, H. O. Channon, Quincy, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting,———— September, 1913. Meetings of Sections, monthly. Pres., V. R. Lansingh, Cleveland, O.; Sec., Preston S. Millar, 29 W. 39th street, New York City. Sections: New York, Secretary, C. L. Law, 124 West 42d street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, J. B. Jackson, 28 North Market street. Pittsburgh, Secretary, J. C. Mundo, Oliver Building.

Indiana Gas Association.—Annual meeting, March, 1913, Indianapolis. Officers: President, Howard L. Olds, Indianapolis; Vice-President, Wm. Wallace, Lafayette; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, Burlington, Ia., May 22, 23, 24, 1913; Officers: President, C. W. Fair, Atlantic, Ia.; Secretary, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, October 17-19. Manhattan, Kas. Officers: President, B. F. Eyer, Manhattan, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association.—Annual meeting, September——1913;———— Officers: President, W. S. Blauvelt, Detroit, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1913; Joplin, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting and Gas Show, Dec. 2-5, 1912. Atlanta, Ga. Officers: President, C. L. Holman, St. Louis, Mo.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, Cleveland, O., May, 1913; Officers: President, M. B. Daly, Cleveland, O; Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February,————1913 Boston. Officers: President, D. D. Barnum, Worcester, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Winter Meeting, December——, Newark N. J.—President, William H. Pettes, Newark, N. J.; Secretary-Treasurer, Arthur H. Osborn Belmar, N. J.

Ohio Gas Association.—Annual meeting, February ———, 1913, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—Annual meeting, May, 1913. President, Noel R. Gascho, Alva, Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, San Jose, Cal., September 16, 17, 18, 1913. Officers: President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, Henry B. Swick, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, York, Pa., April, 1913; Officers, President, H. H. Ganser, Norristown, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 13, 1912; monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city

Southern Gas Association.—Annual meeting, Charlotte, N. C., April———— 1913, Officers: President, C. E. White, Montgomery, Ala.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. April————1913, Galveston, Tex. Officers: President, F. M. Lege, Jr., Galveston, Tex.; Secretary, H. S. Cooper, 405 Slaughter Bldg., Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May ———— 1913, Milwaukee, Wis. Officers: President, I. F. Wortendyke, Janesville, Wis.; Secretary-Treasurer, Henry Harmon, Milwaukee, Wis.